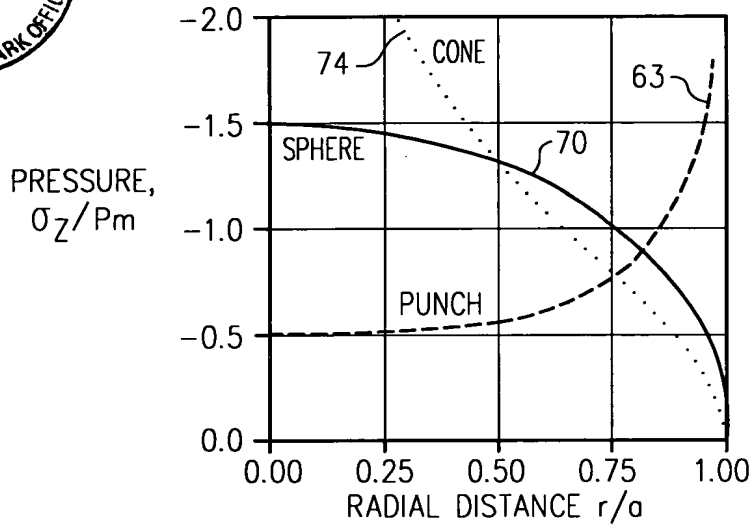


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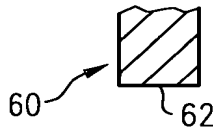
**FIG. 1**

PRIOR ART



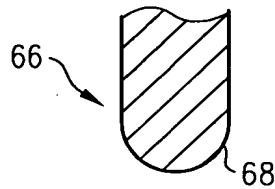
**FIG. 2**

PRIOR ART



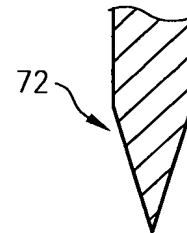
**FIG. 3**

PRIOR ART

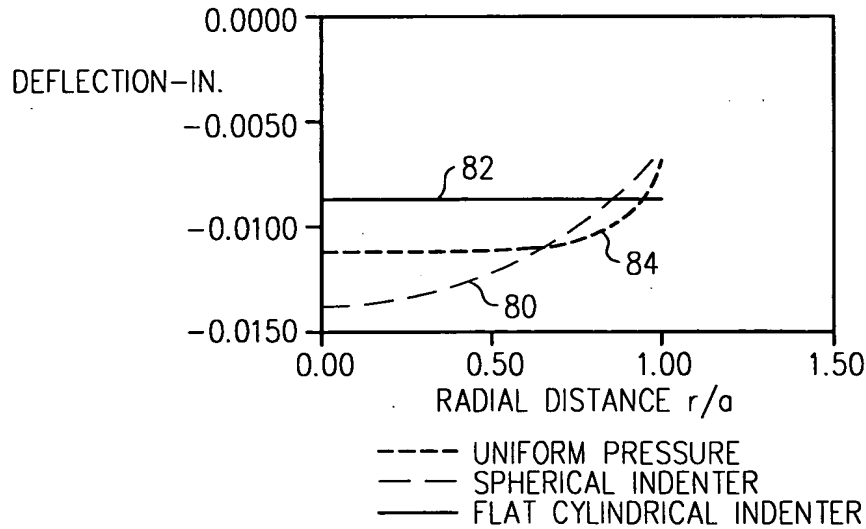


**FIG. 4**

PRIOR ART



**FIG. 5**



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FIG. 6

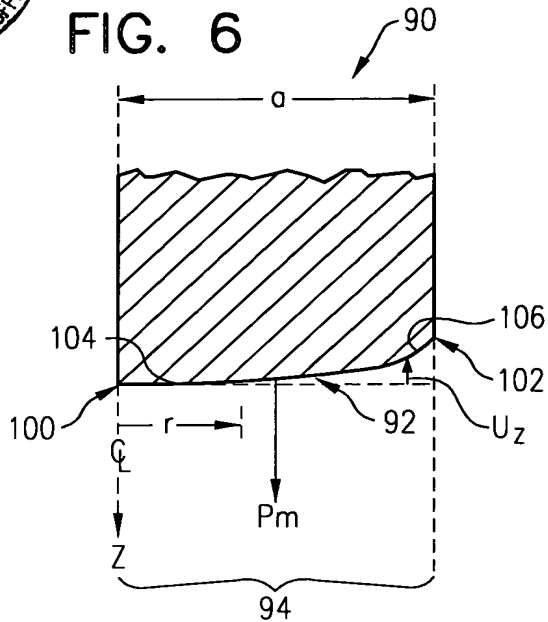


FIG. 7

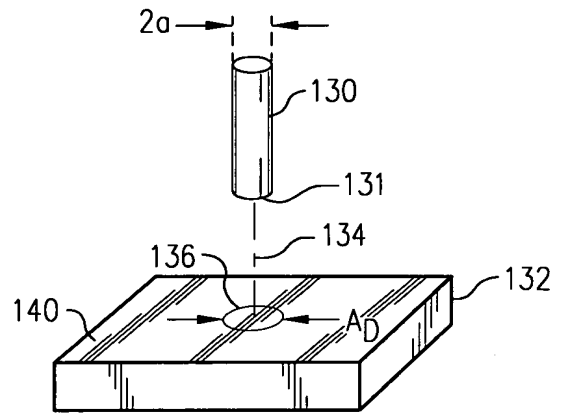


FIG. 9

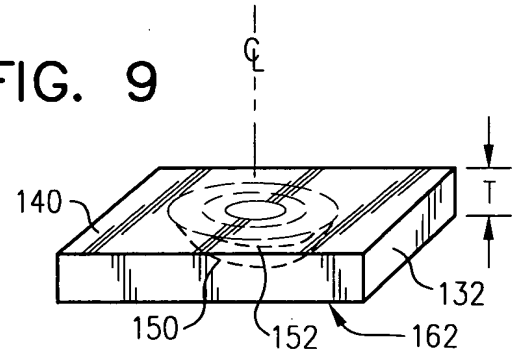


FIG. 8

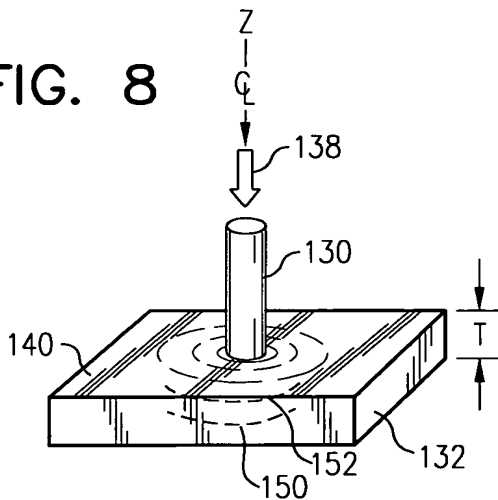
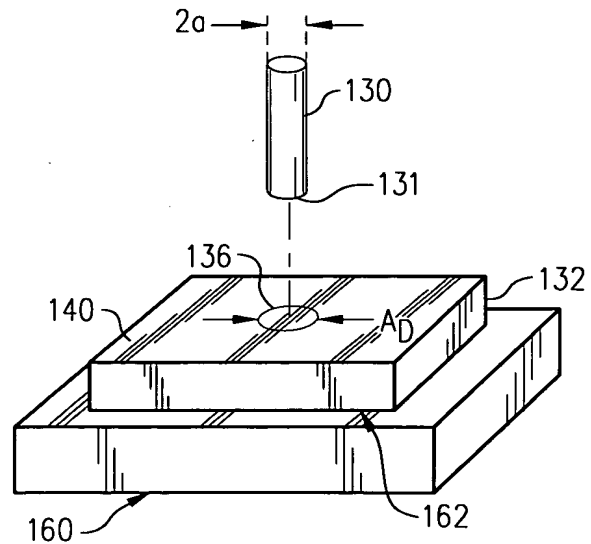
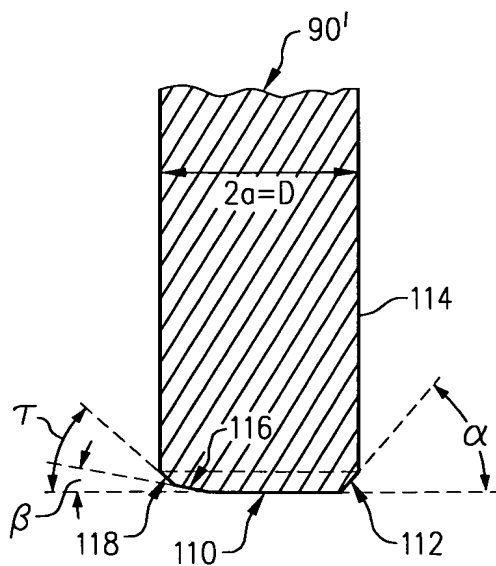


FIG. 10





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FIG. 15

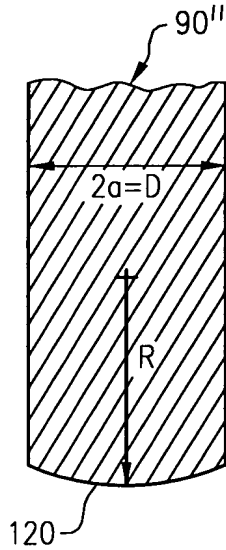


FIG. 16

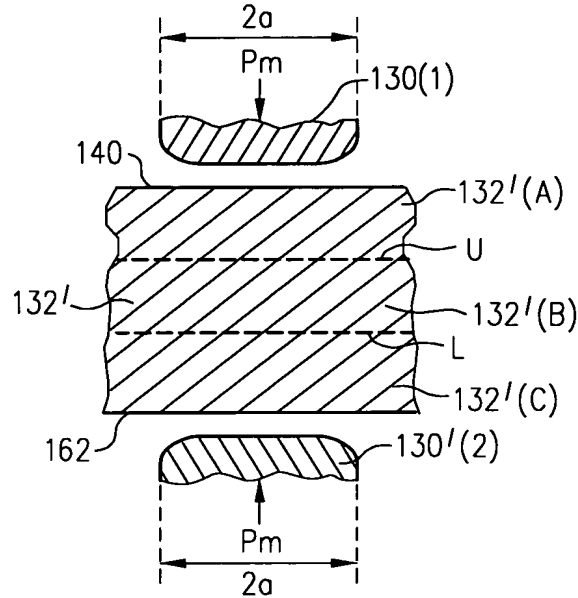


FIG. 17

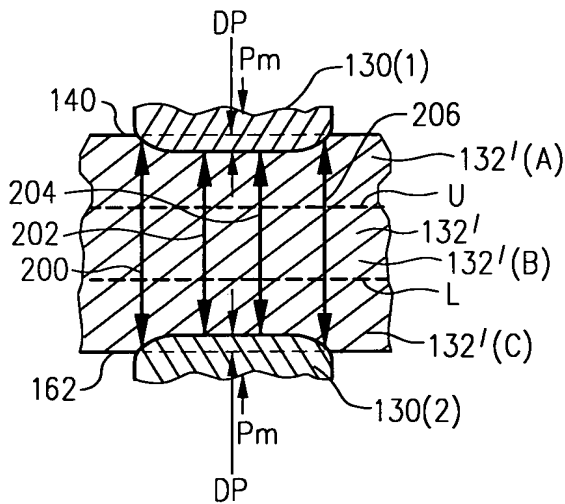


FIG. 18

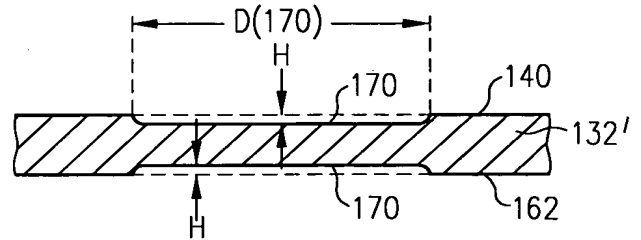


FIG. 20

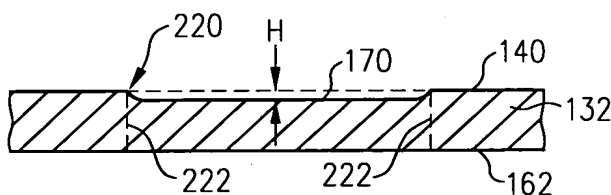


FIG. 19

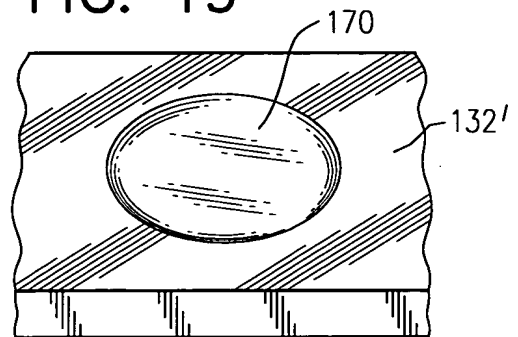




FIG. 21

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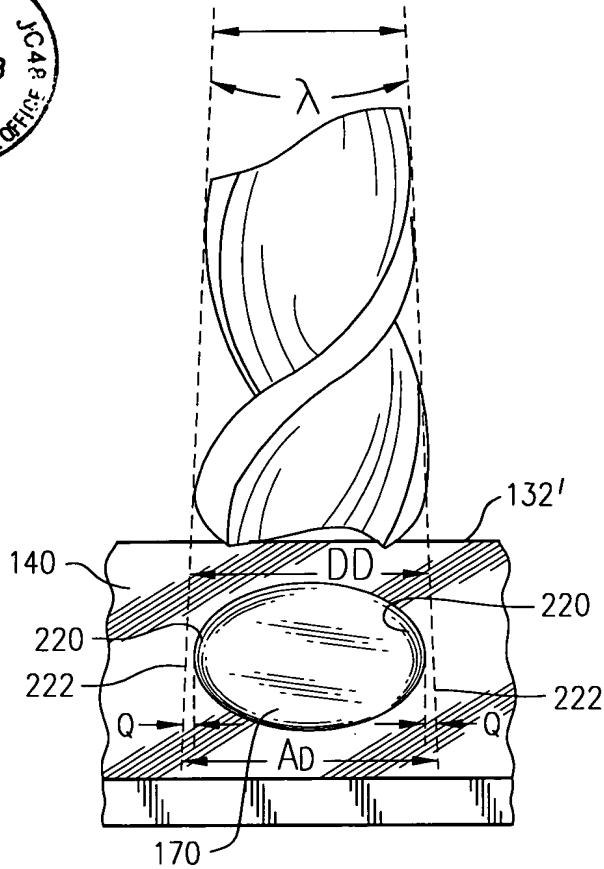


FIG. 22

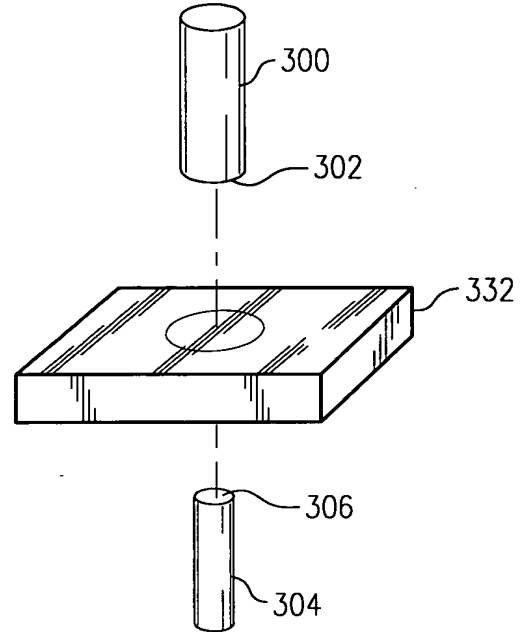


FIG. 24

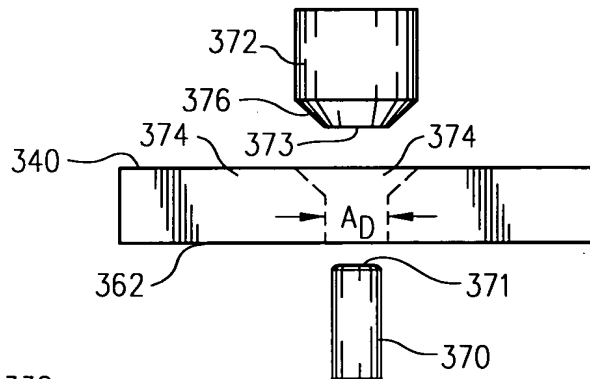


FIG. 23

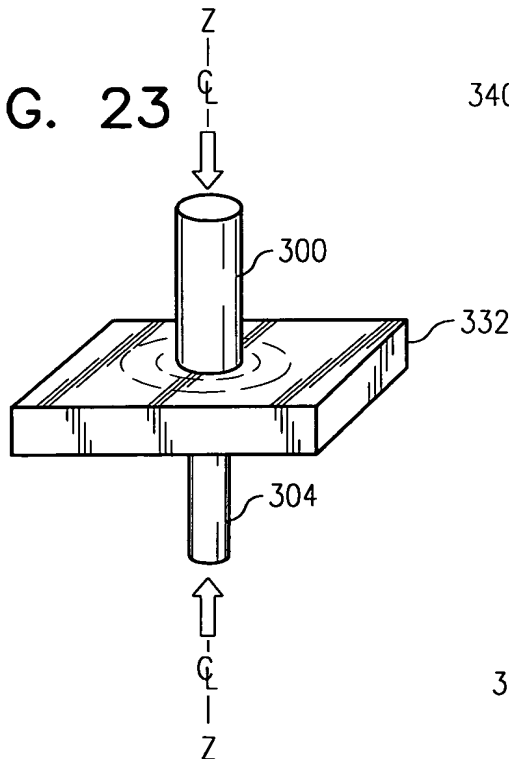


FIG. 25

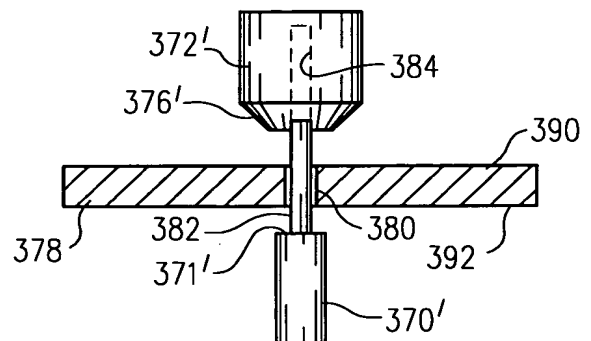


FIG. 27

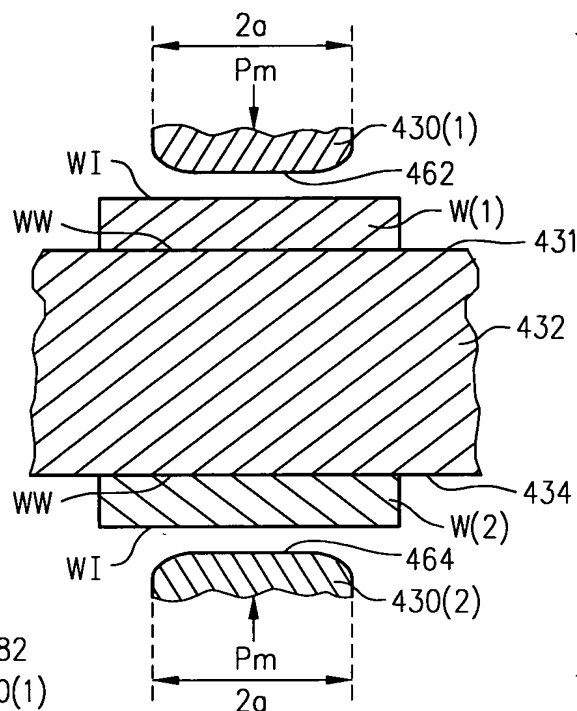
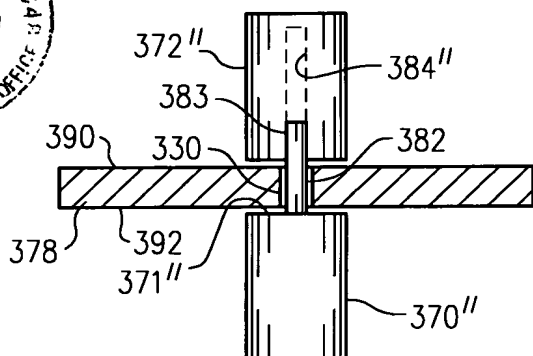
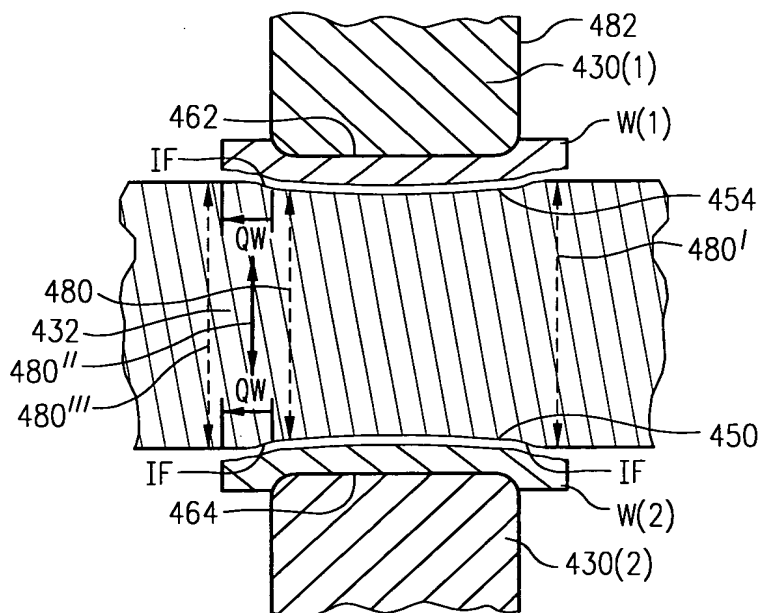


FIG. 28



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FIG. 32

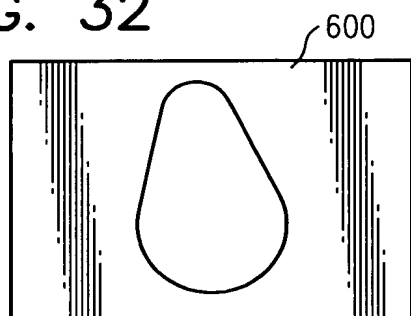
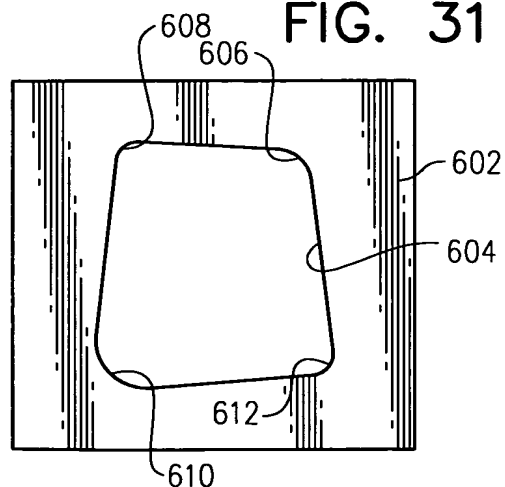


FIG. 31





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FIG. 29

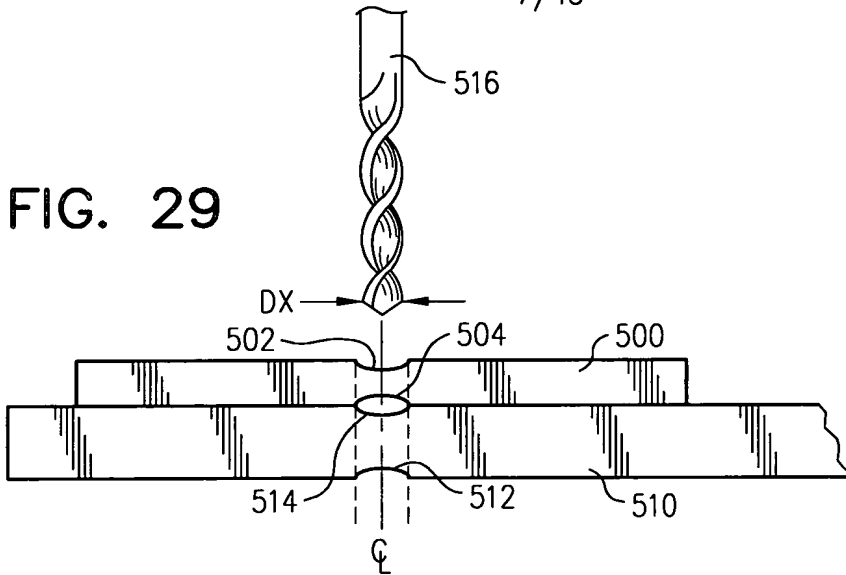


FIG. 33

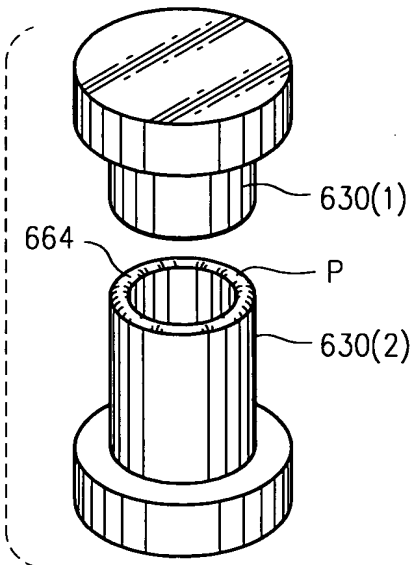


FIG. 30

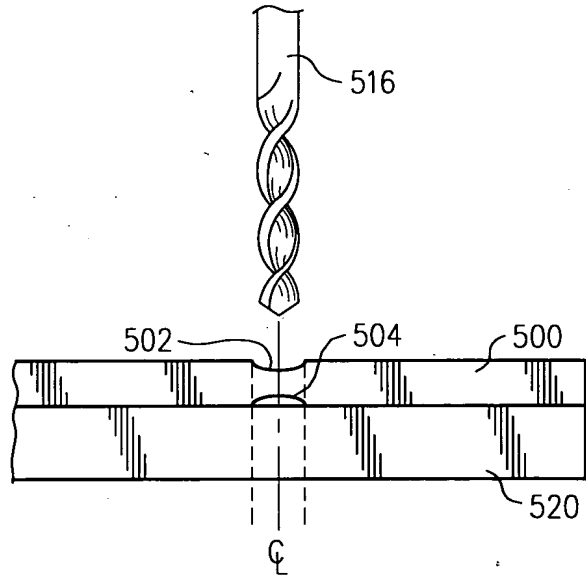
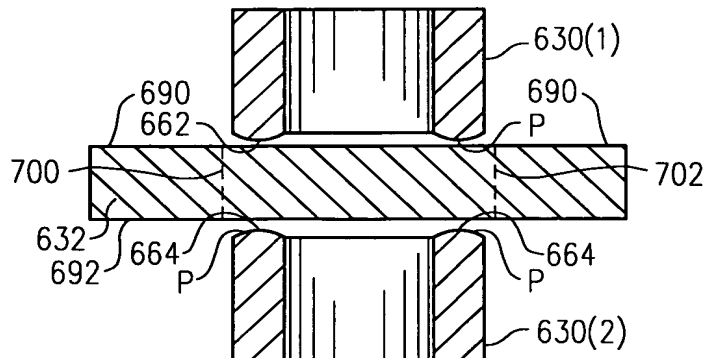


FIG. 34





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FIG. 35

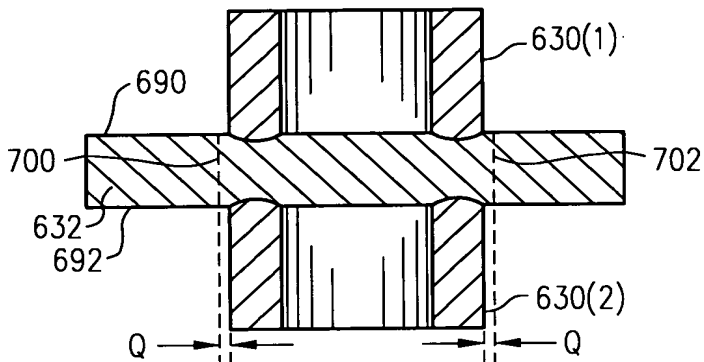


FIG. 36

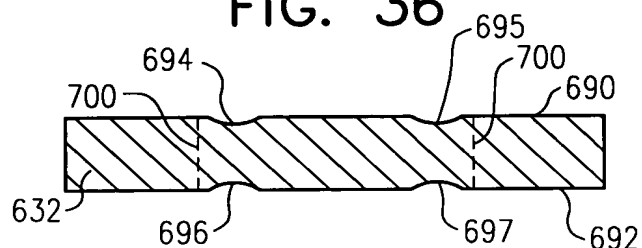


FIG. 37

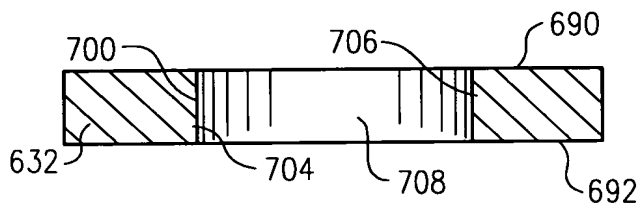


FIG. 48

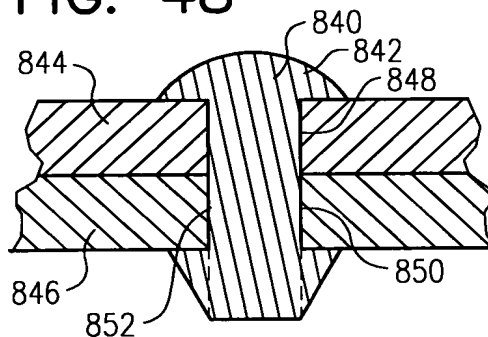
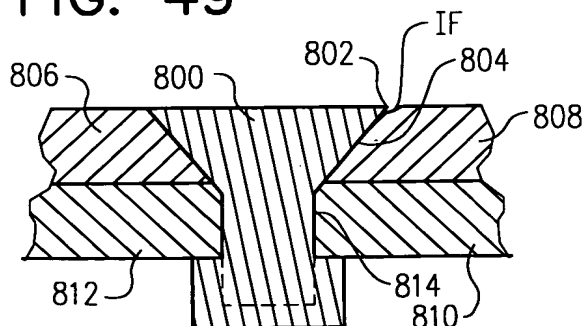


FIG. 49





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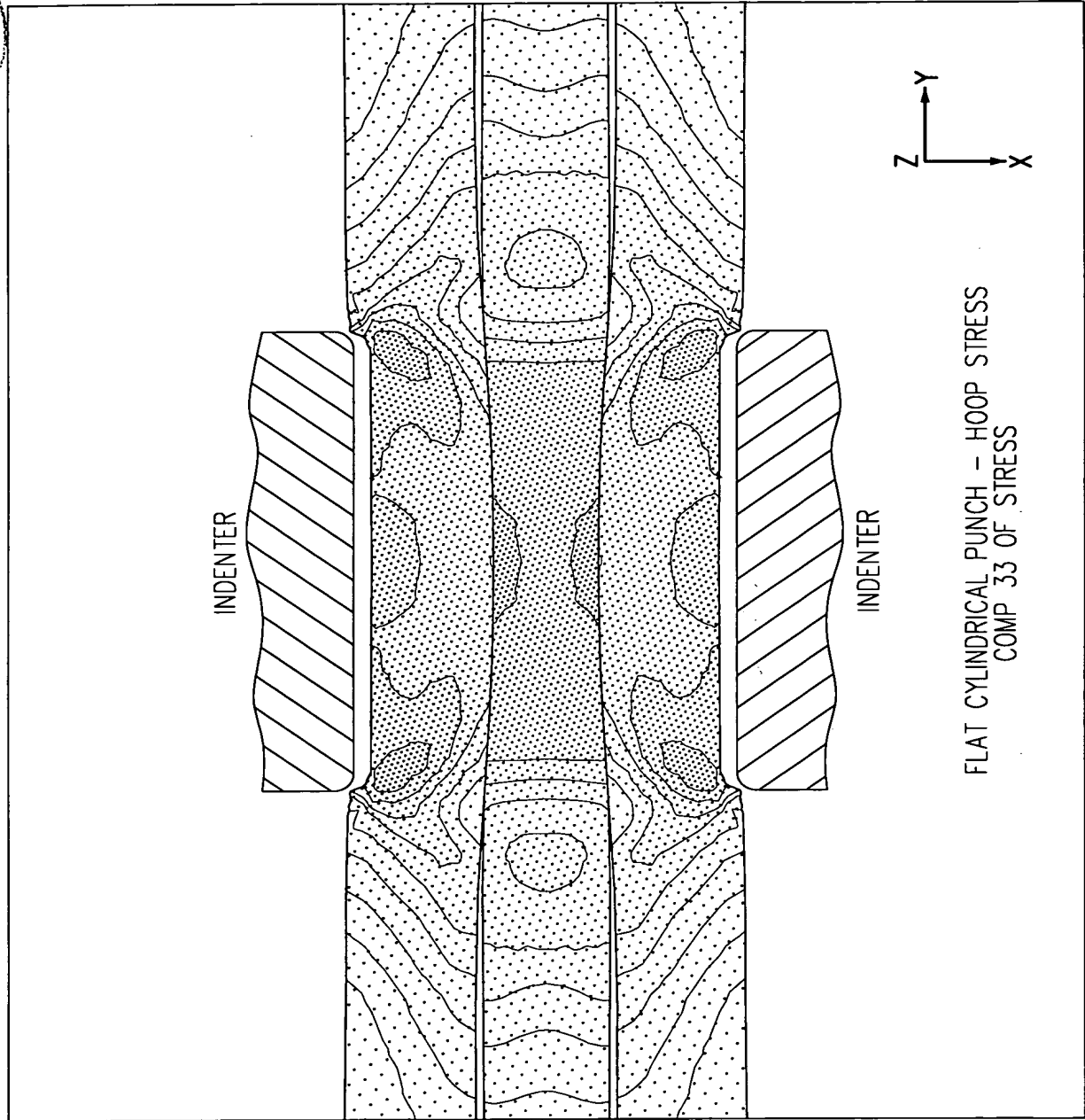
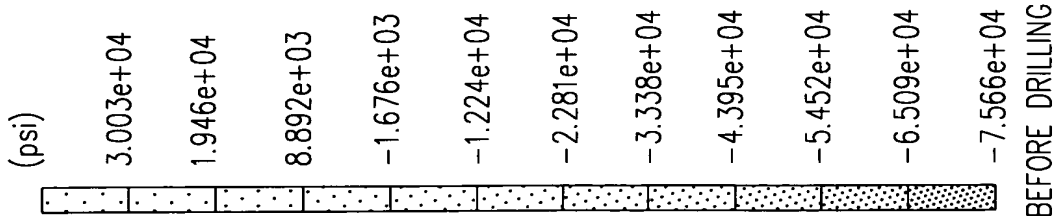


FIG. 38

INC: 30  
 TIME: 2.000e+00



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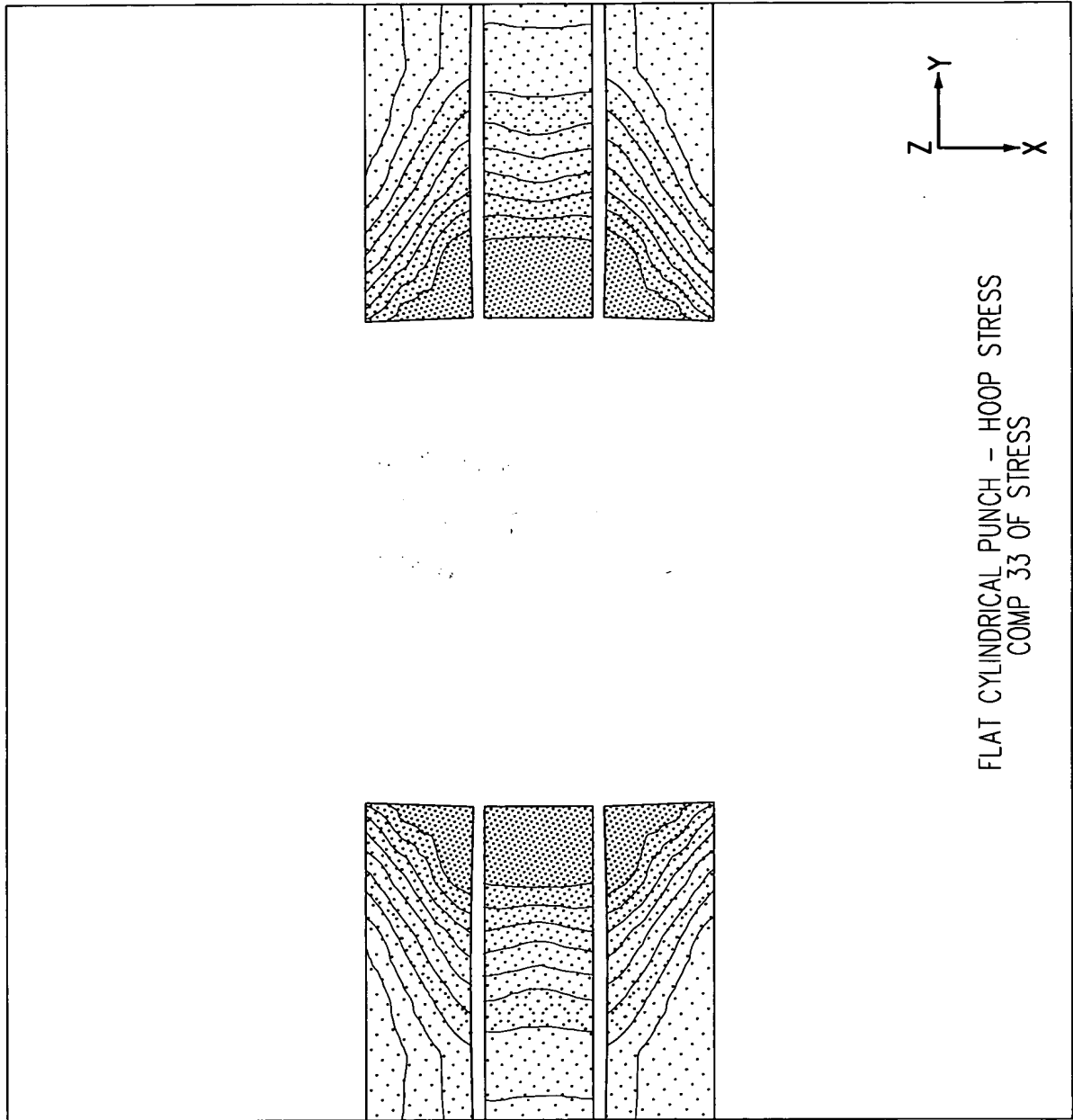
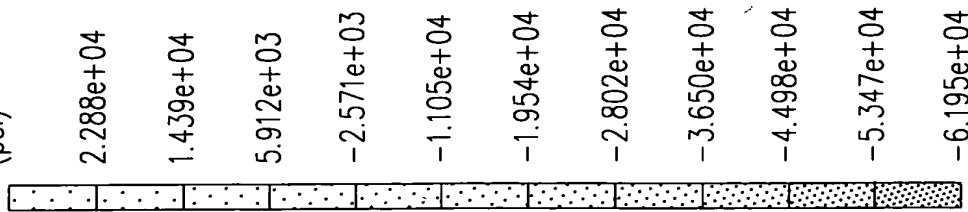


FIG. 39

INC: 40  
 TIME: 4.000e+00

(psi)



AFTER DRILLING

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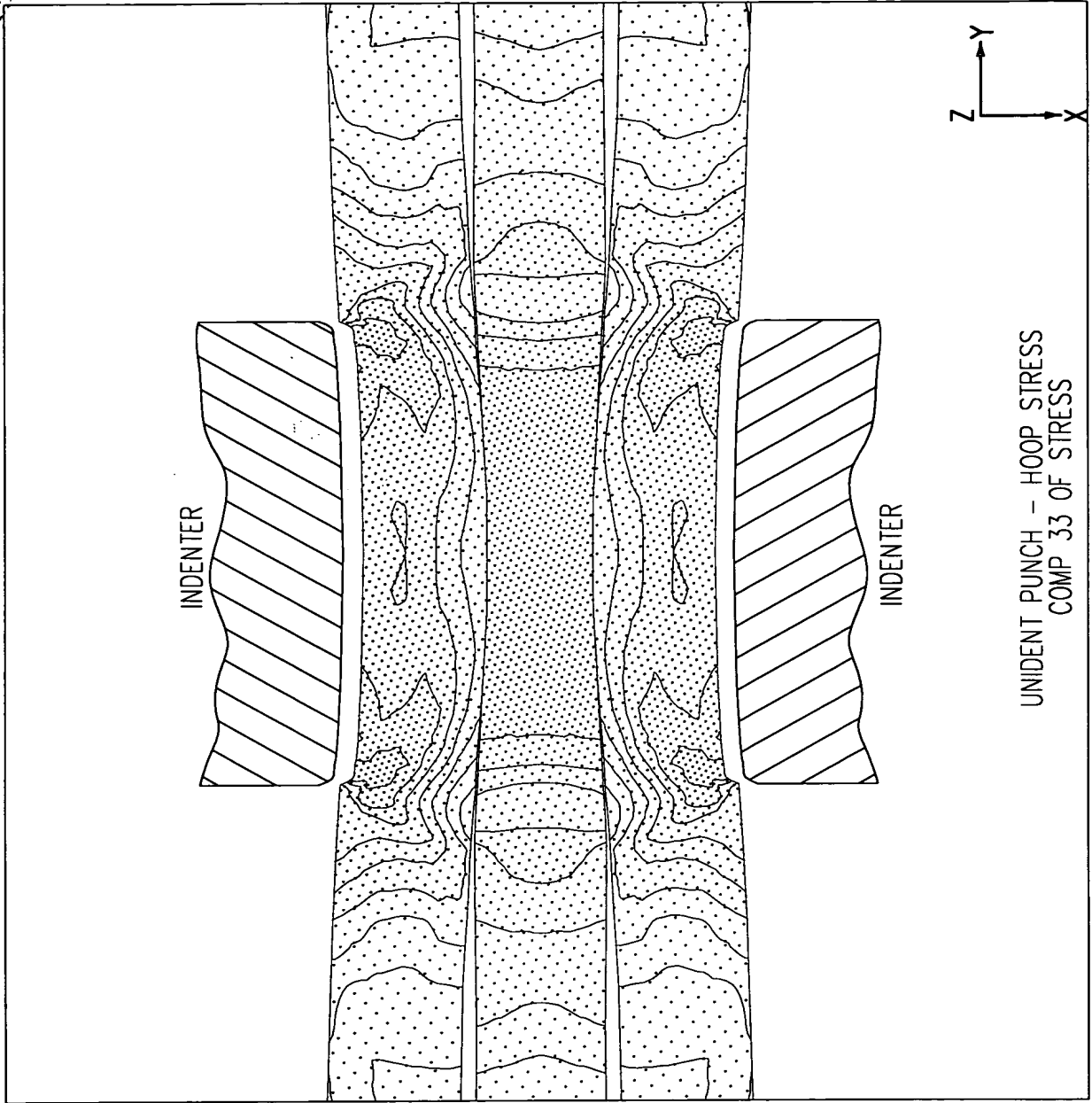
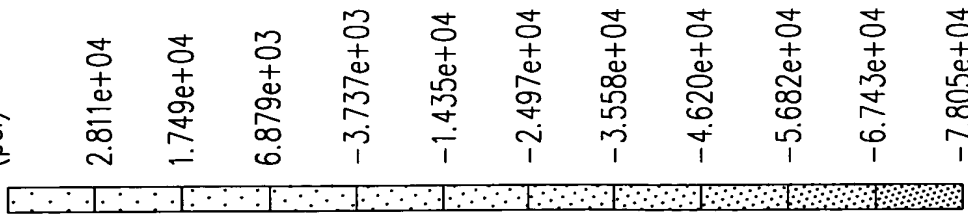


FIG. 40

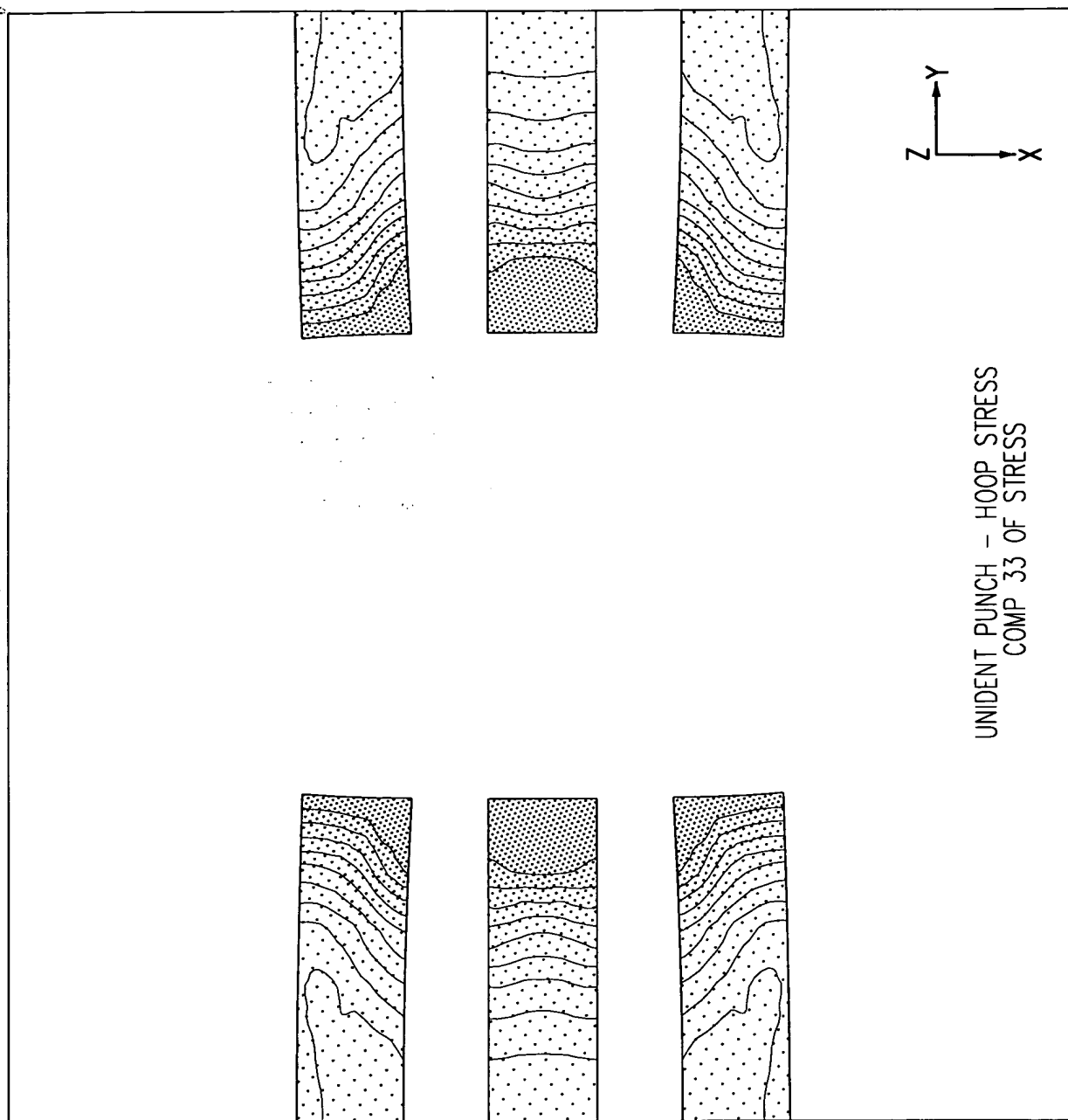
INC: 30  
 TIME: 2.000e+00

(psi)



BEFORE DRILLING

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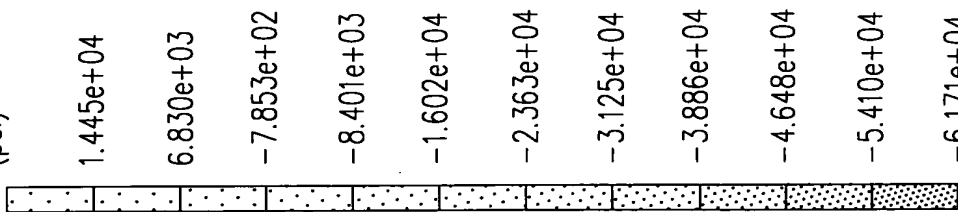


UNIDENT PUNCH - HOOP STRESS  
 COMP 33 OF STRESS

FIG. 41

INC: 40  
 TIME: 4.000e+00

(psi)



AFTER DRILLING

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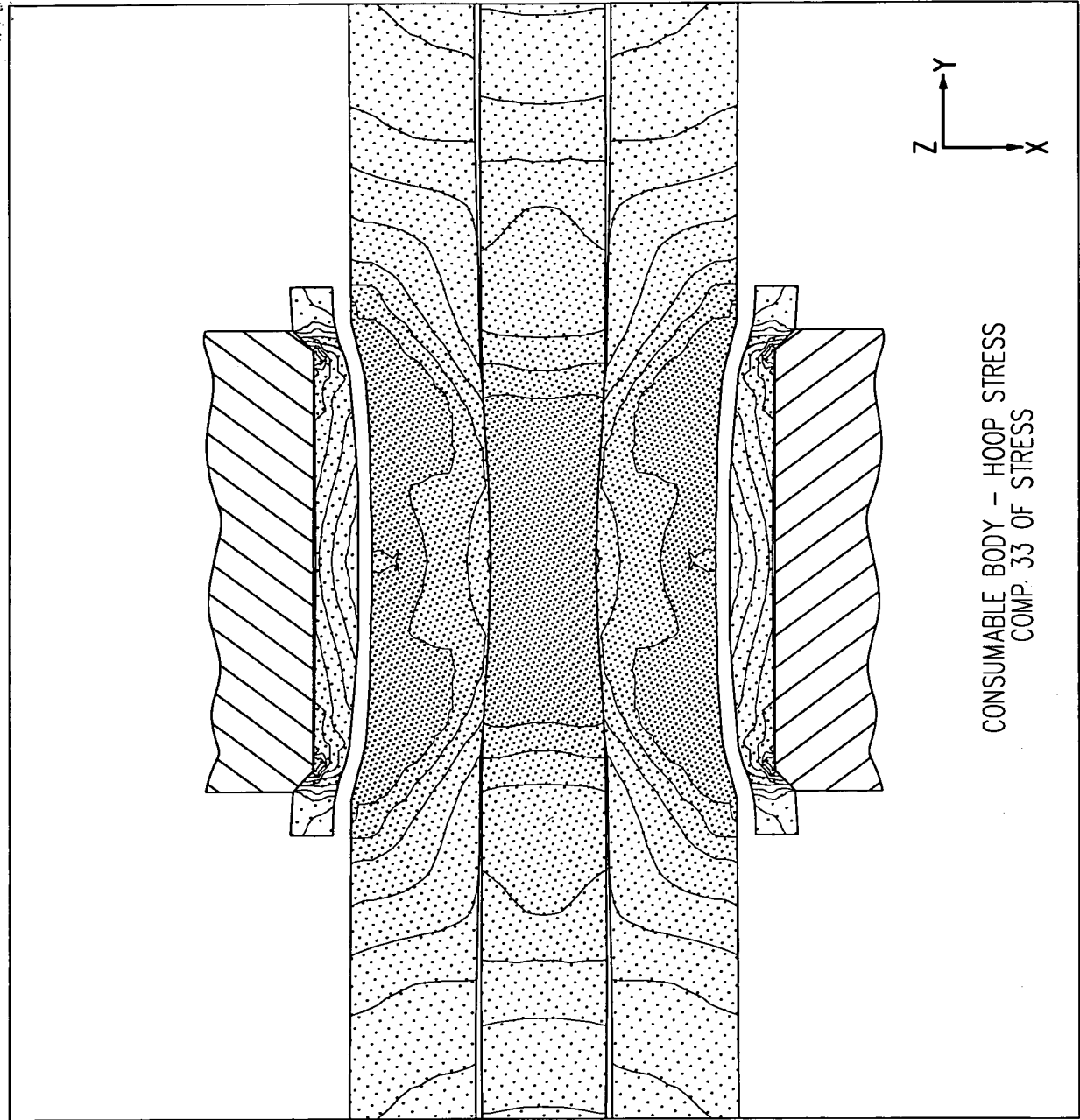
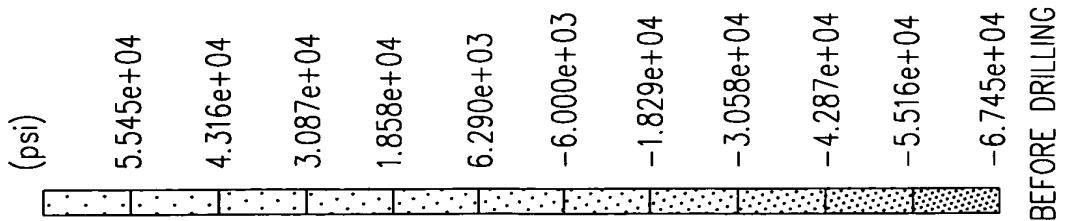
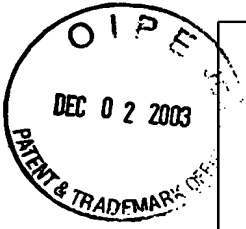


FIG. 42

INC: 30  
 TIME: 2.000e+00



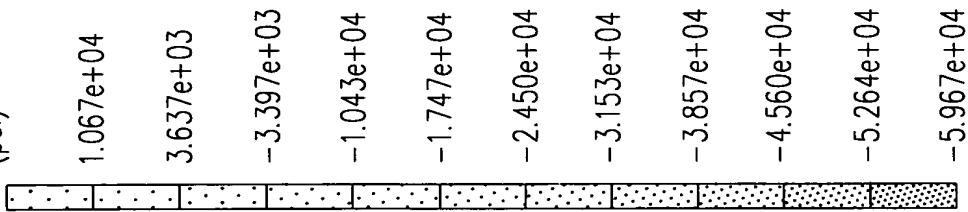
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**FIG. 43**

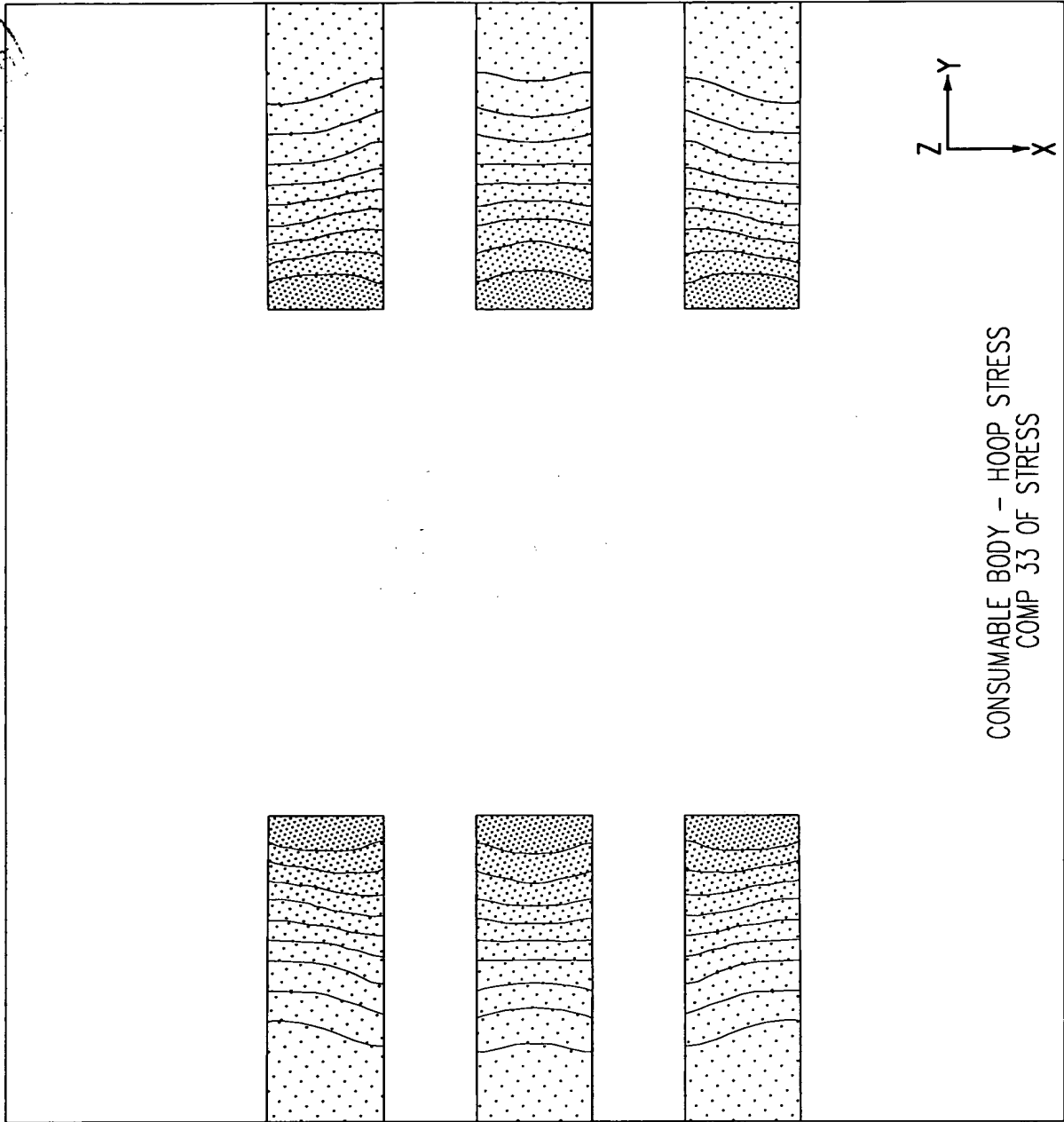
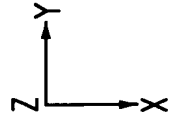
INC: 40  
 TIME: 4.000e+00

(psi)



AFTER DRILLING

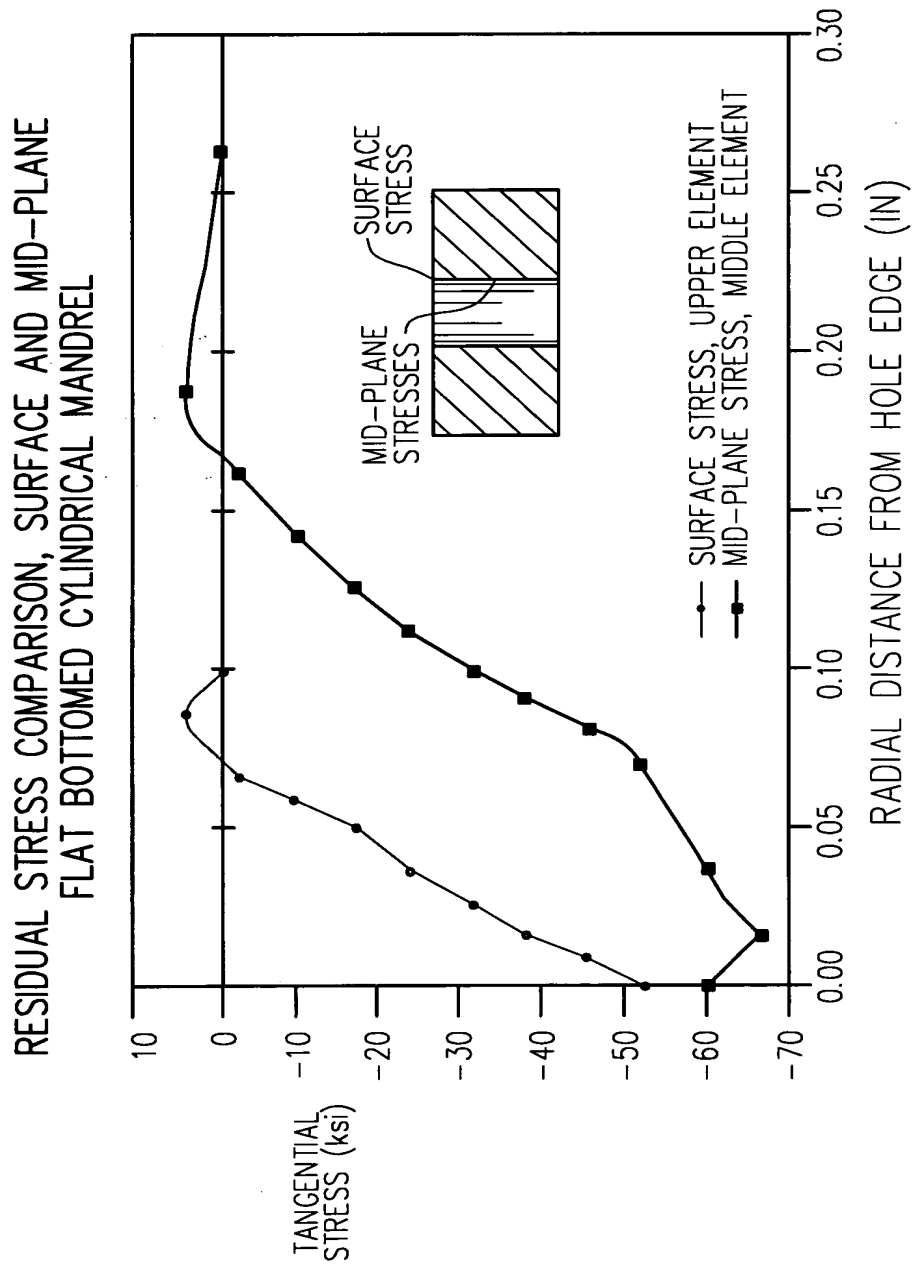
CONSUMABLE BODY - HOOP STRESS  
 COMP 33 OF STRESS



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**FIG. 44**  
PRIOR ART

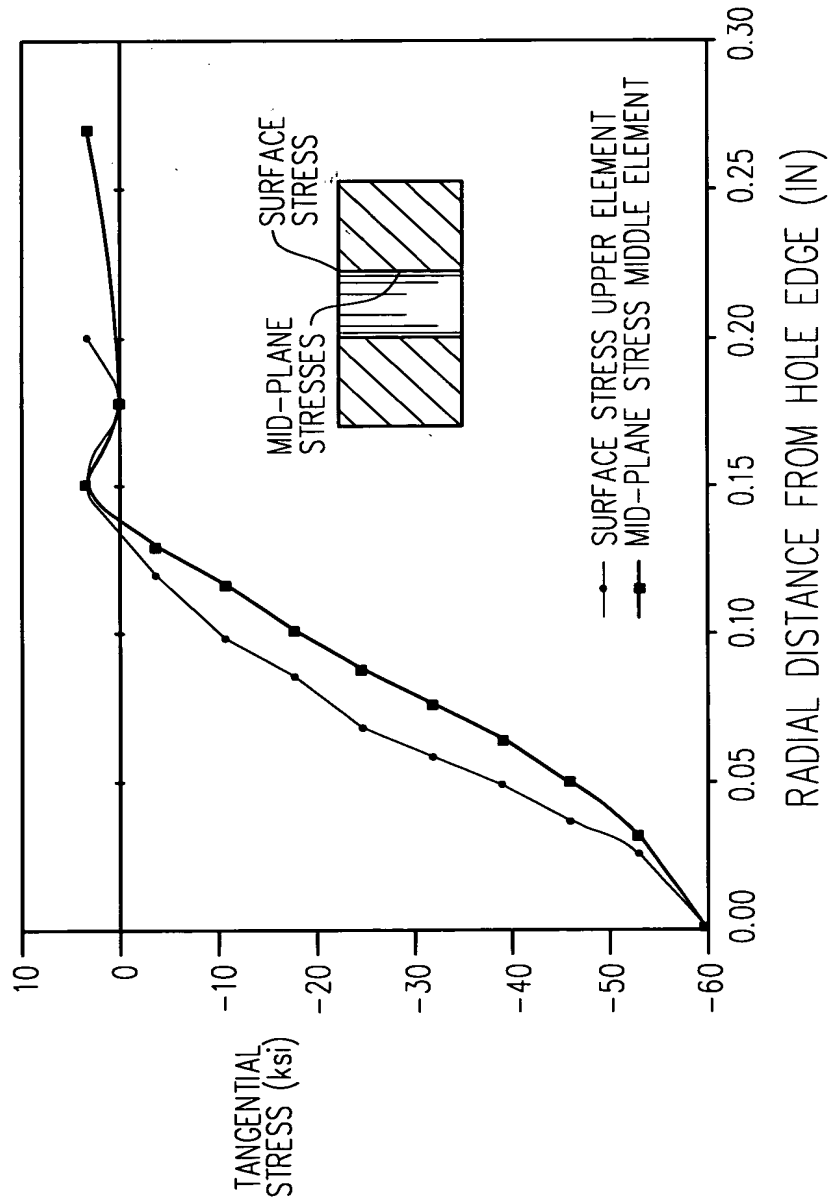


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FIG. 45

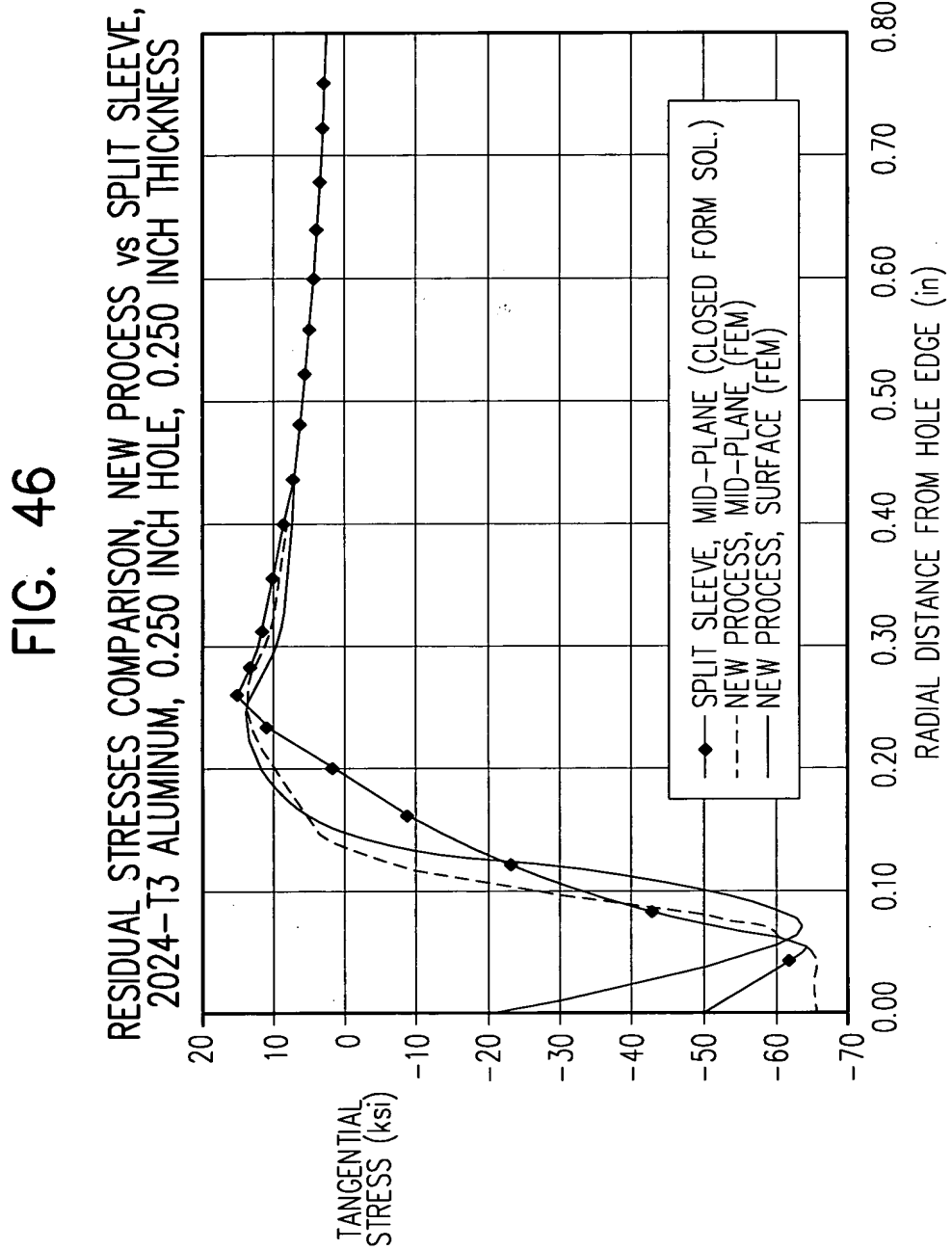
RESIDUAL STRESS COMPARISON, SURFACE AND MID-PLANE  
USING UNIFORM PRESSURE PROFILE INDENTER







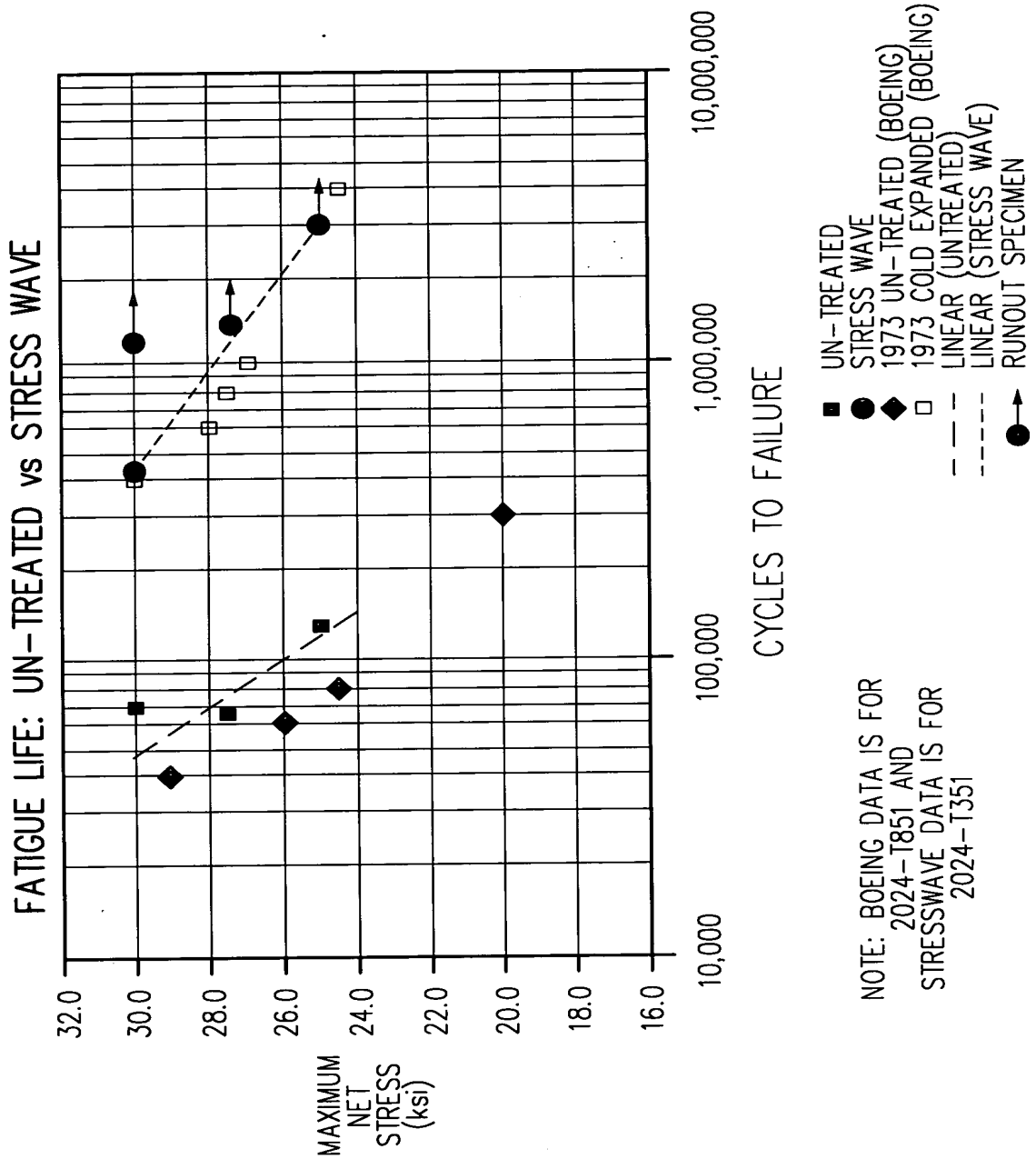
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FIG. 47



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FIG. 50

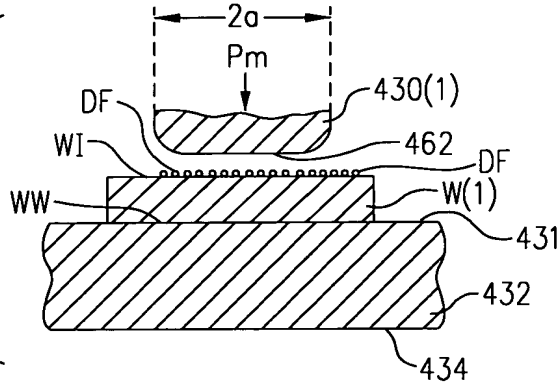


FIG. 52

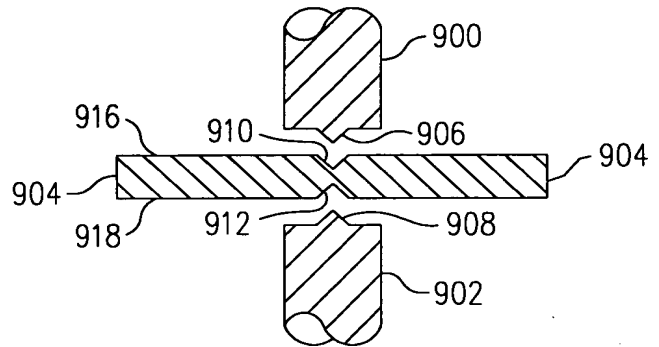


FIG. 53

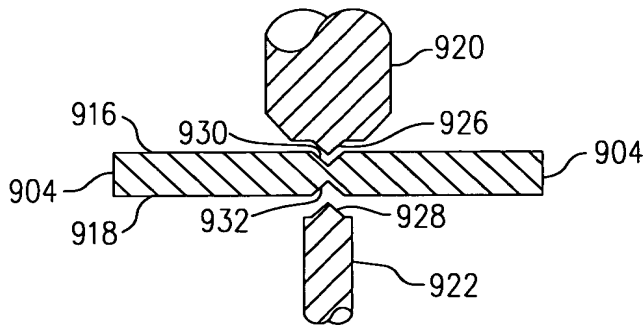
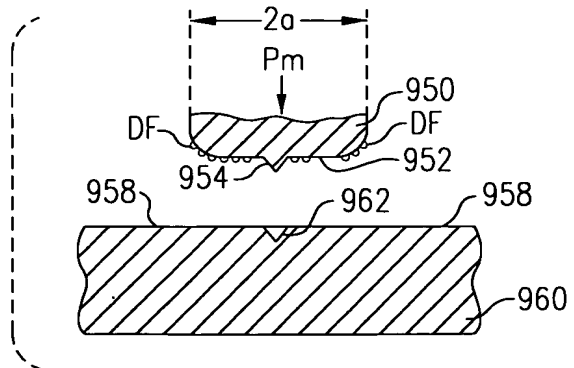


FIG. 54



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FIG. 51

FIG. 51A

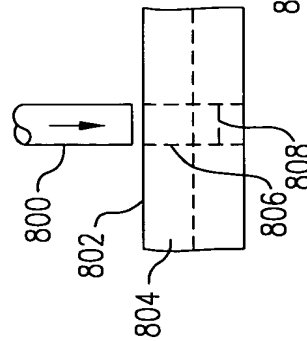


FIG. 51B

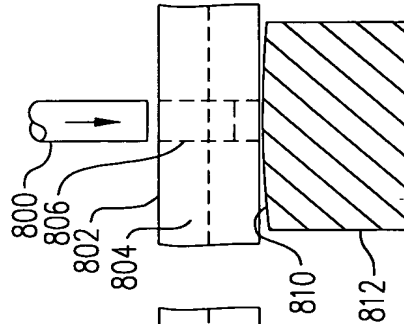


FIG. 51C

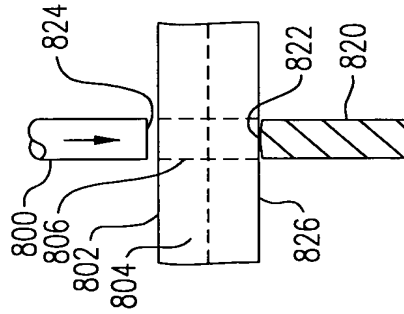


FIG. 51D

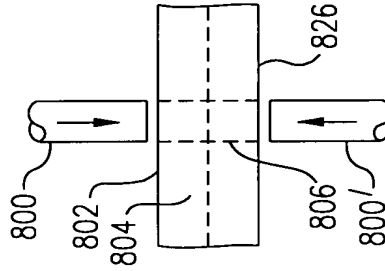
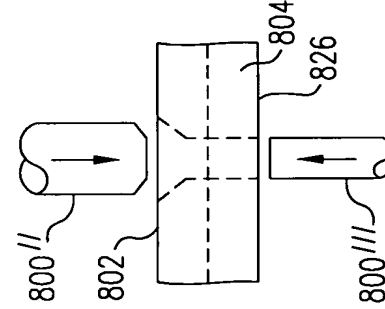


FIG. 51E





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FIG. 55

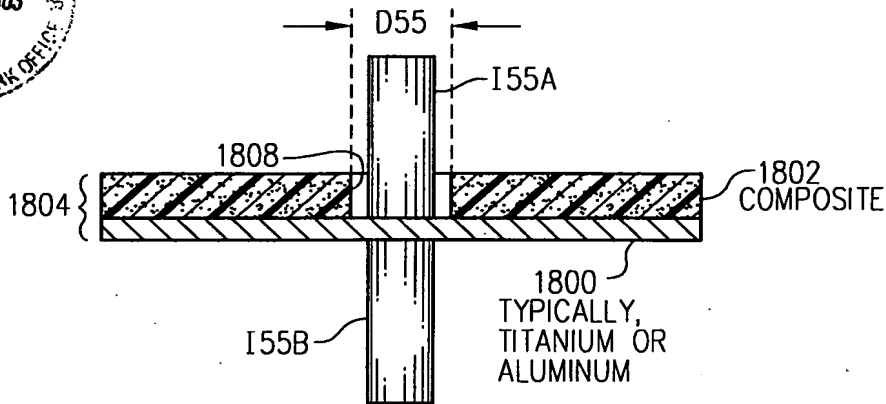


FIG. 56

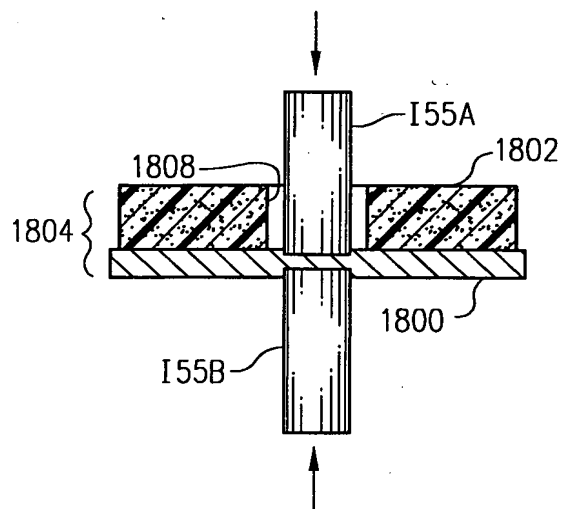


FIG. 57

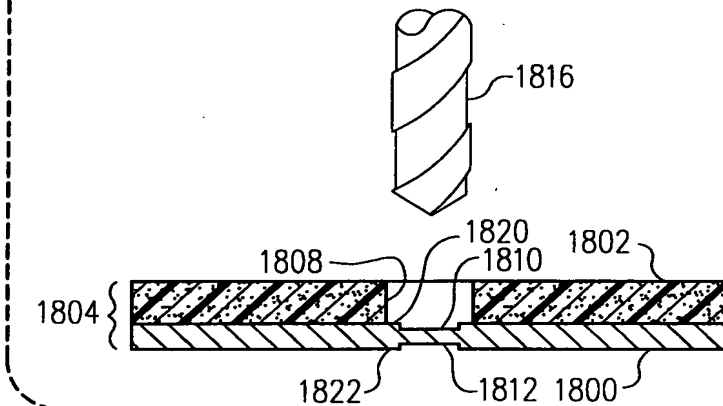
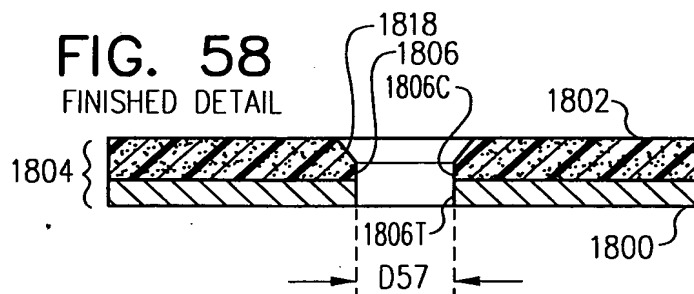


FIG. 58

FINISHED DETAIL

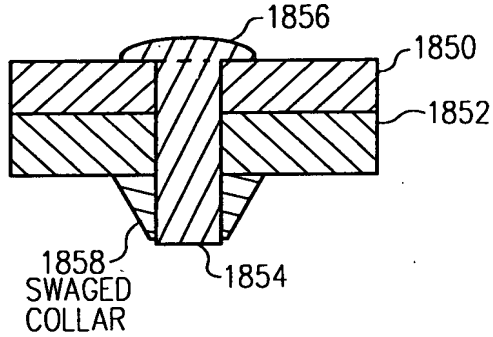


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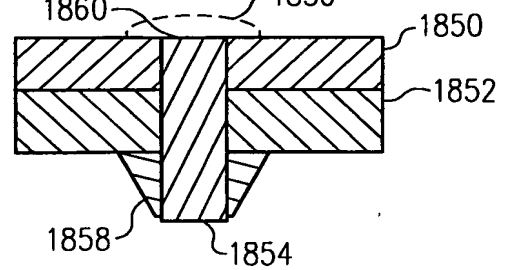
**FIG. 59**

TEMPORARY (TACK) FASTENER CONFIGURATION



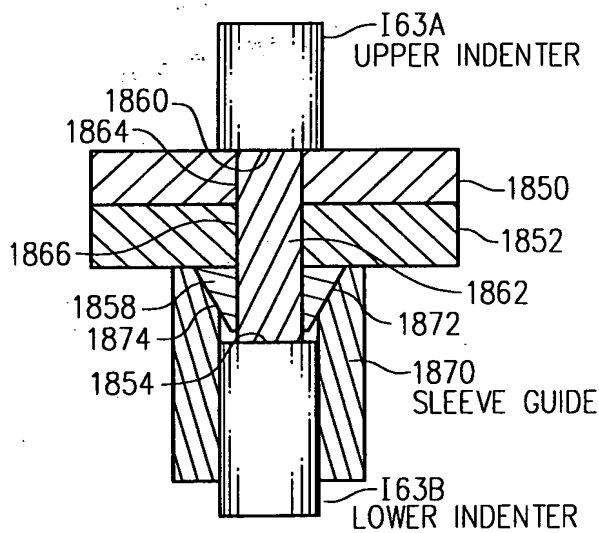
**FIG. 60**

SHAVE FASTENER  
HEAD OFF



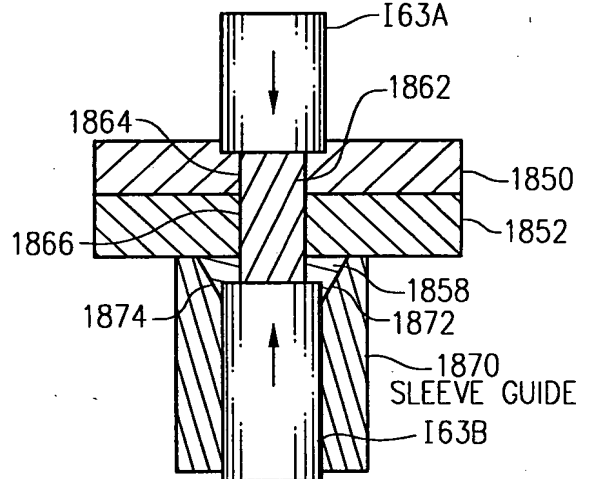
**FIG. 61**

ALIGN INDENTERS WITH  
TACK FASTENER CENTER



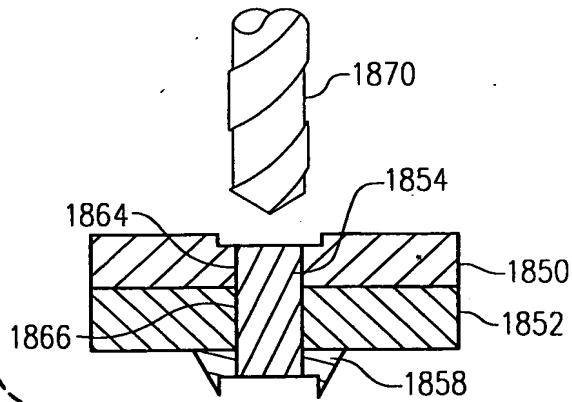
**FIG. 62**

ACTUATE INDENTERS



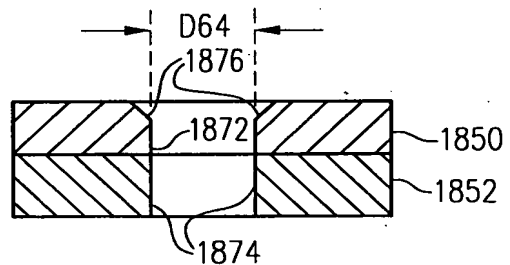
**FIG. 63**

DRILL TO BOLT DIAMETER



**FIG. 64**

FINISHED TREATED HOLE



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FIG. 65

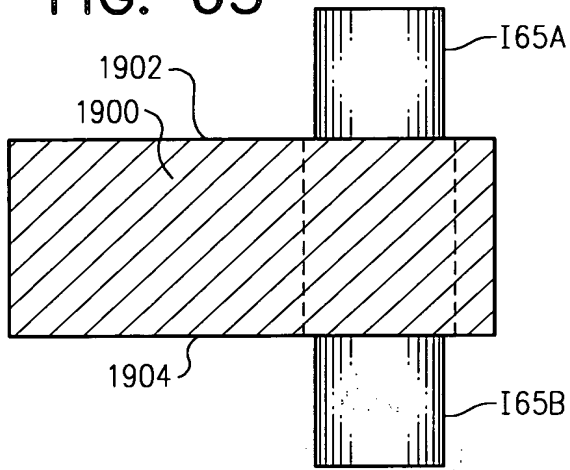


FIG. 66

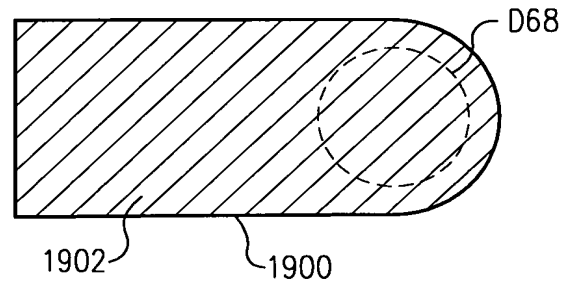


FIG. 67

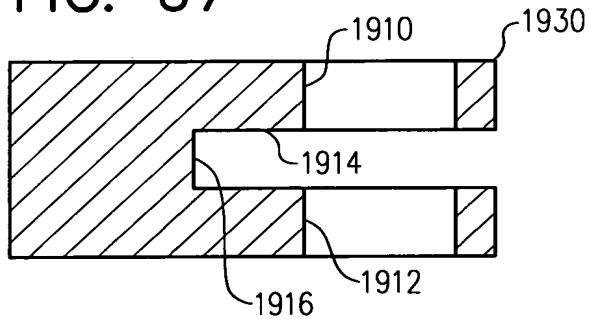
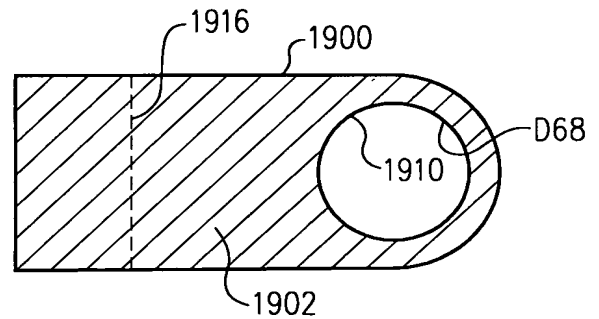


FIG. 68

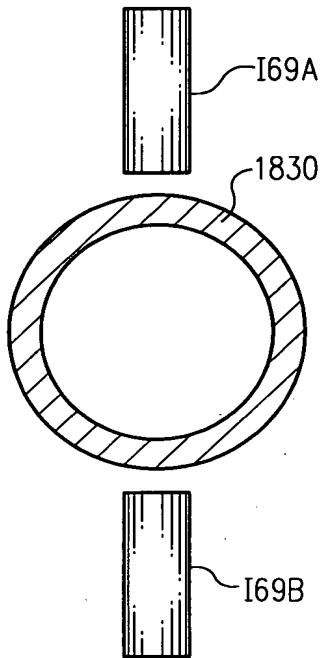


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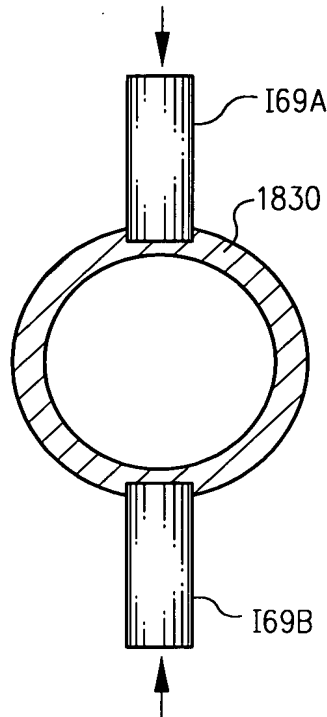


## TREATMENT OF TUBULAR BAR WITHOUT INTERNAL SUPPORT

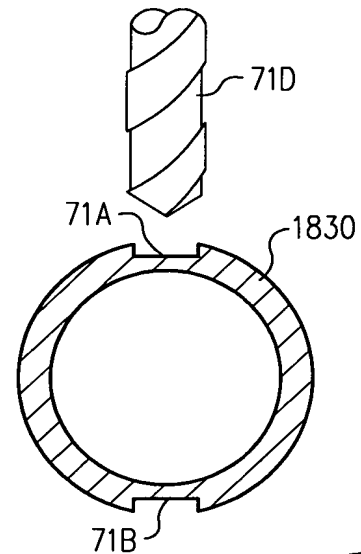
**FIG. 69**  
SETUP STEP



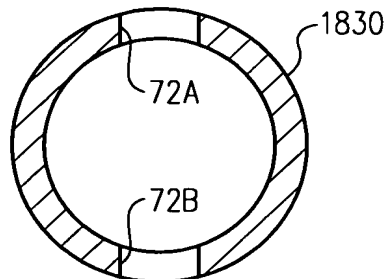
**FIG. 70**  
PROCESSING



**FIG. 71**  
DRILL HOLE



**FIG. 72**  
FINAL CONFIGURATION





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# TREATMENT OF TUBULAR BAR WITH INTERNAL SUPPORT

FIG. 73

CROSS-SECTIONAL VIEW  
 OF PROCESSING STEP

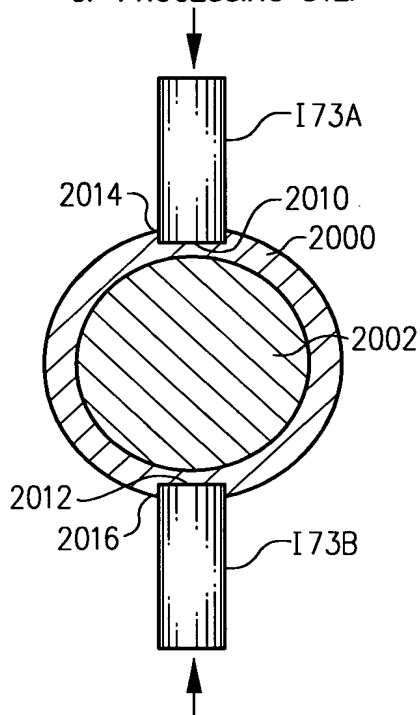
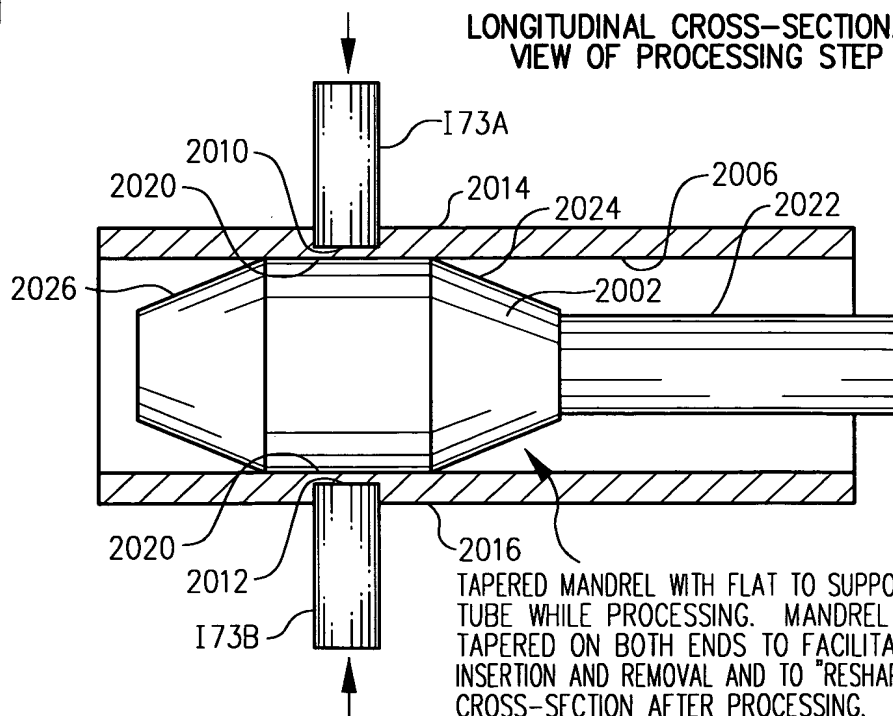


FIG. 74

LONGITUDINAL CROSS-SECTIONAL  
 VIEW OF PROCESSING STEP



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CROSS SECTION OF HOLLOW TUBE  
TREATED WITH INDENTER END SHAPE  
THAT CONFORMS TO TUBE DIAMETER

FIG. 75

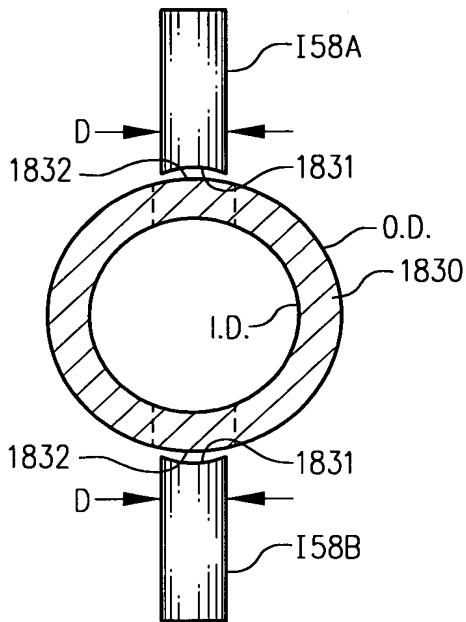


FIG. 76

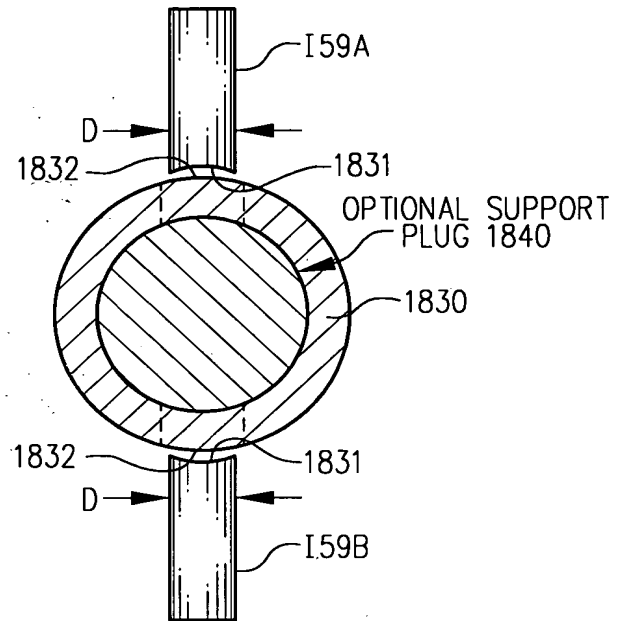
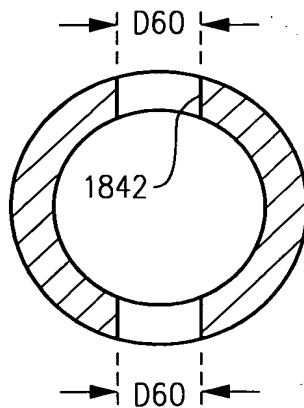


FIG. 77

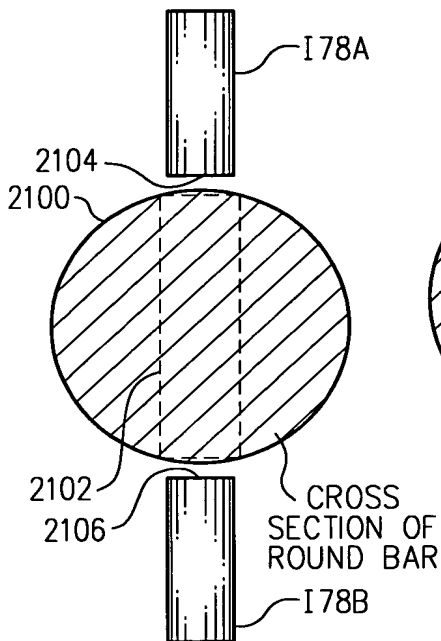


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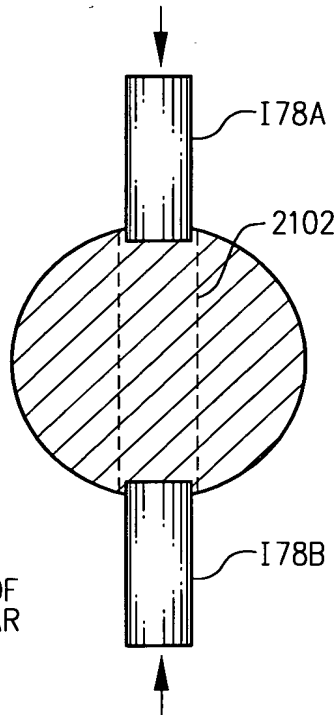


TREATMENT OF SOLID BAR

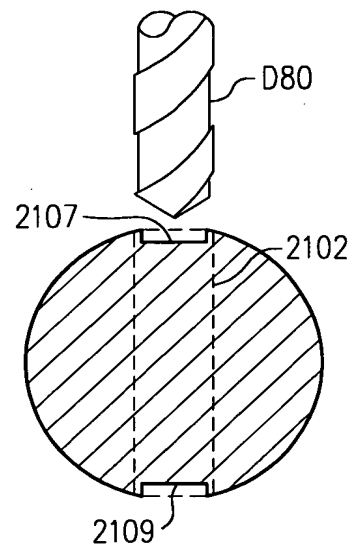
**FIG. 78**  
SETUP STEP



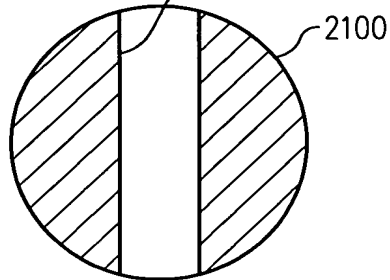
**FIG. 79**  
PROCESSING



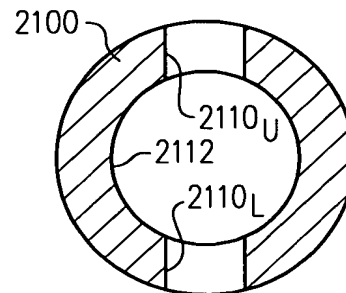
**FIG. 80**  
DRILL HOLE



**FIG. 81**  
FINAL  
CONFIGURATION



**FIG. 82**



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TREATMENT OF AN INITIALLY OVERSIZED SOLID BAR

FIG. 83  
SETUP STEP

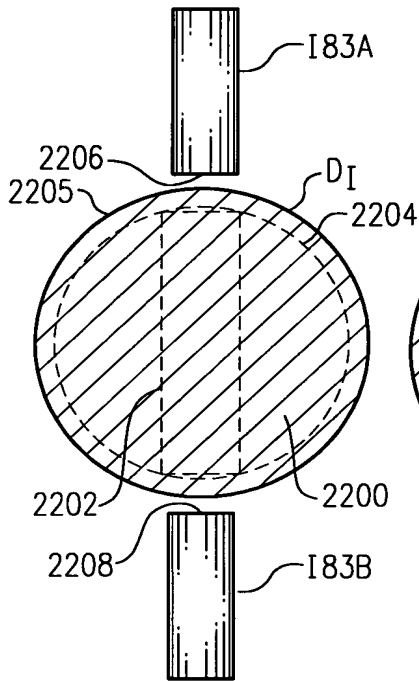


FIG. 84  
PROCESSING

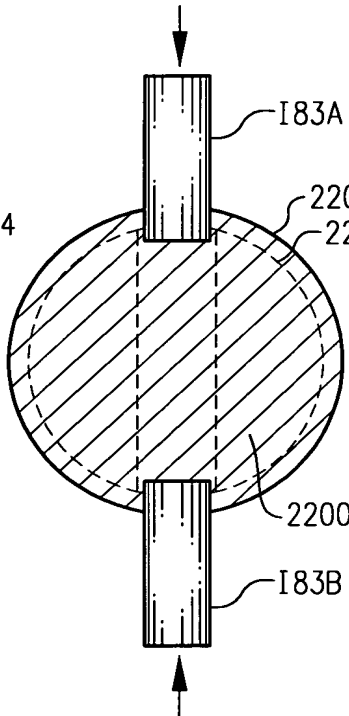


FIG. 85  
DRILL HOLE

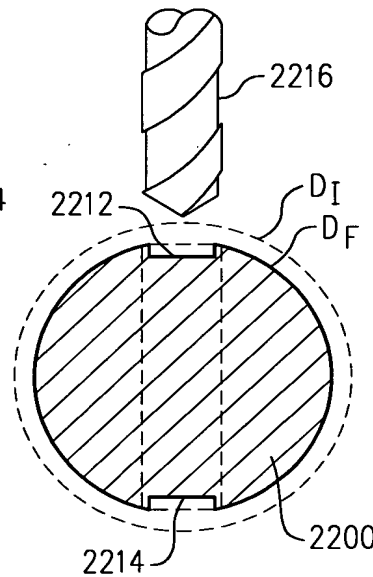


FIG. 86  
FINAL  
CONFIGURATION

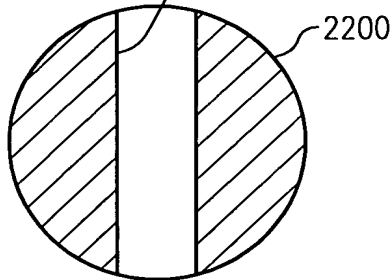
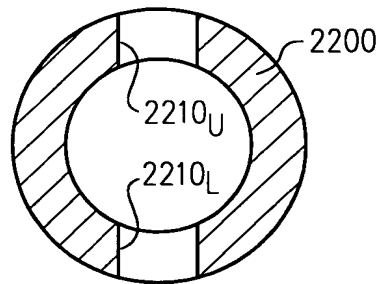


FIG. 87



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TREATMENT OF AN INITIALLY OVERSIZED SOLID BAR  
WITH OPPOSING "FLATS" TO FACILITATE TREATMENT

FIG. 88  
SETUP STEP

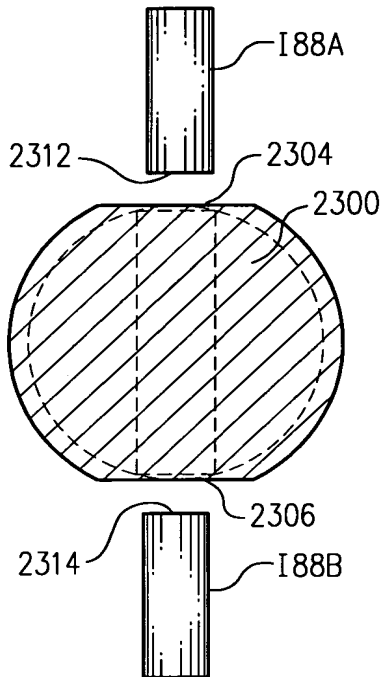


FIG. 89  
PROCESSING

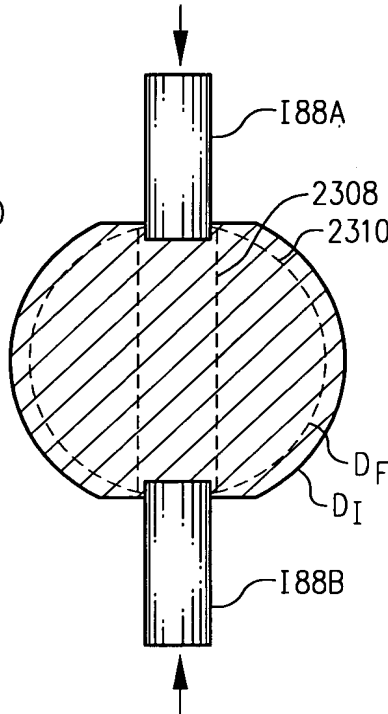


FIG. 90  
DRILL HOLE

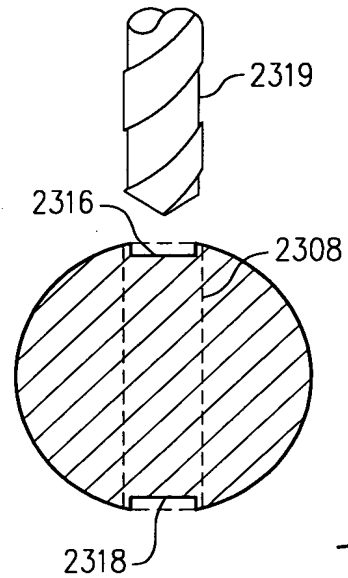


FIG. 91  
FINAL  
CONFIGURATION

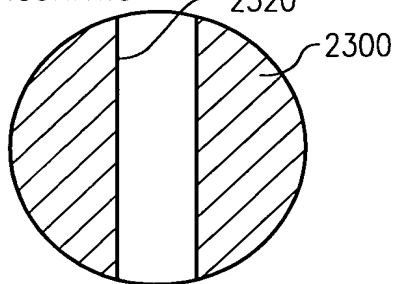
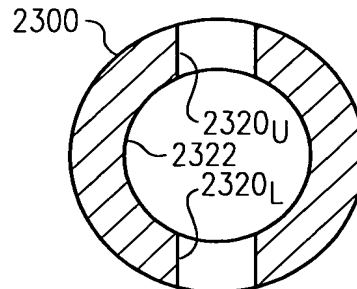


FIG. 92

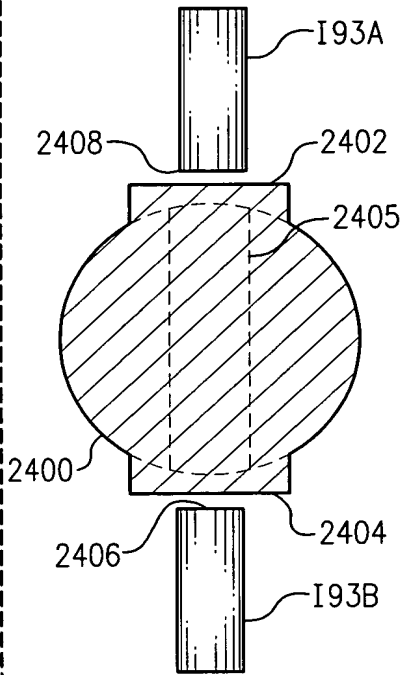


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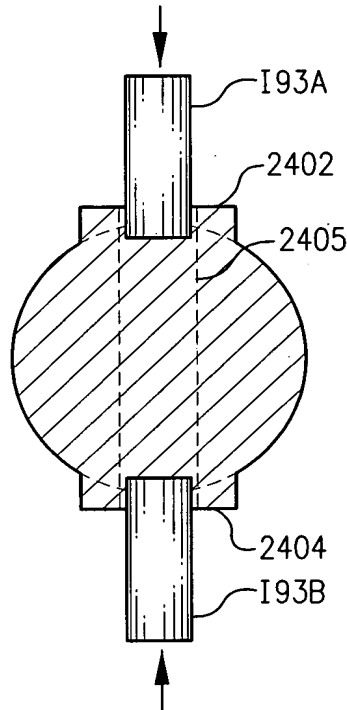


TREATMENT OF A SOLID BAR WITH MILLED OR  
 INTEGRAL "FLATS" TO FACILITATE THE PROCESS

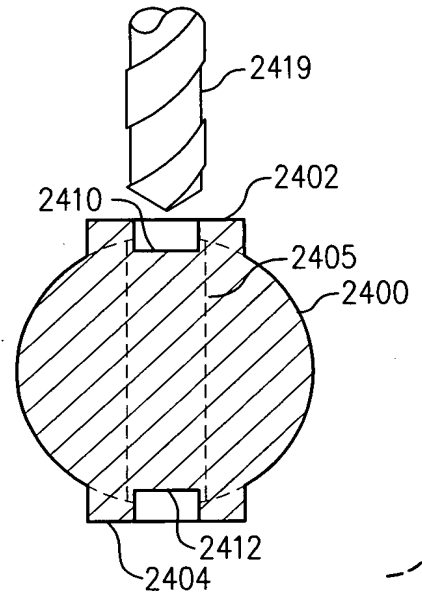
**FIG. 93**  
 SETUP STEP



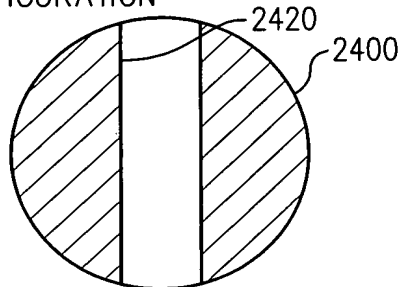
**FIG. 94**  
 PROCESSING



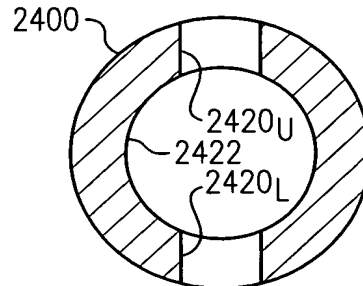
**FIG. 95**  
 DRILL HOLE



**FIG. 96**  
 FINAL  
 CONFIGURATION



**FIG. 97**

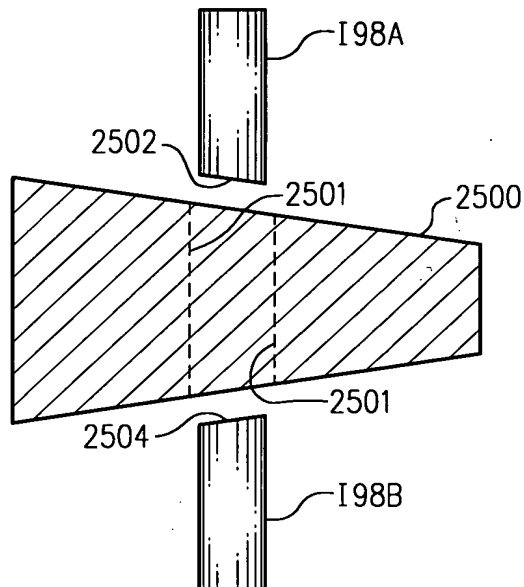


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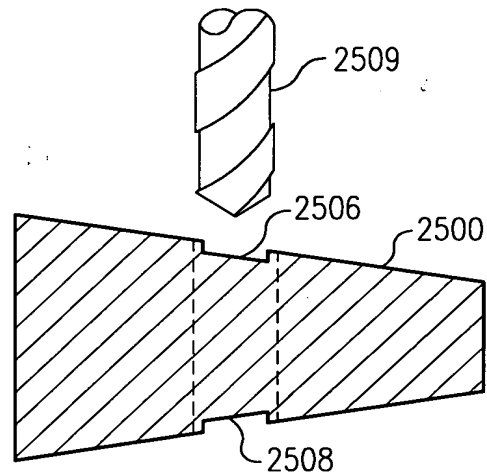


## TREATMENT OF A STRUCTURE WITH TWO TAPERED SURFACES

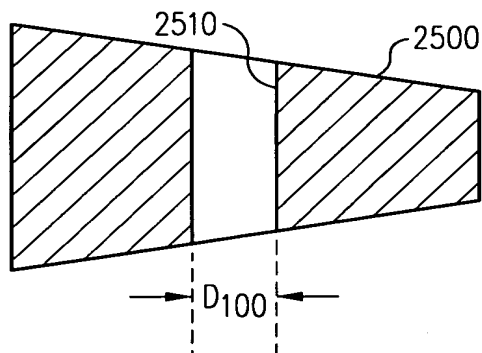
**FIG. 98**  
PROCESS SETUP STEP



**FIG. 99**  
DRILL



**FIG. 100**  
FINAL CONFIGURATION



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FIG. 101  
PROCESS SETUP STEP

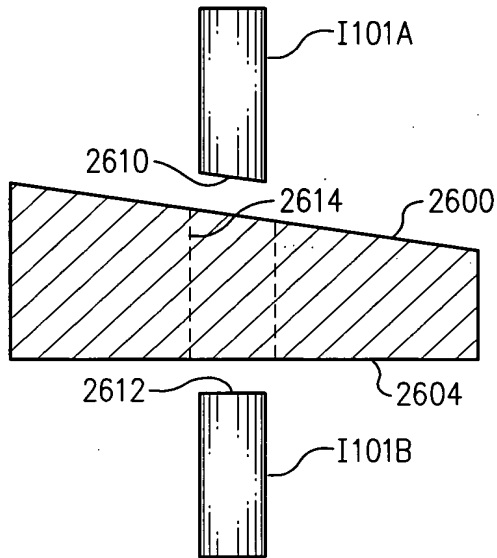


FIG. 101A

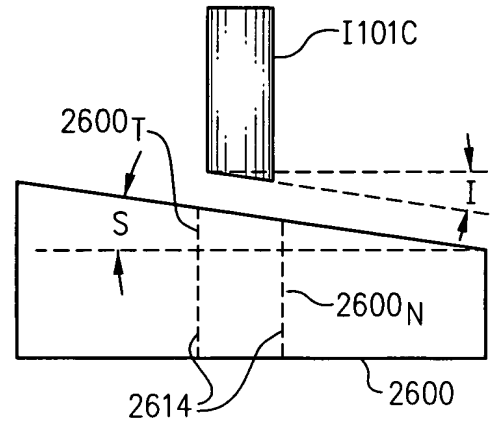


FIG. 102

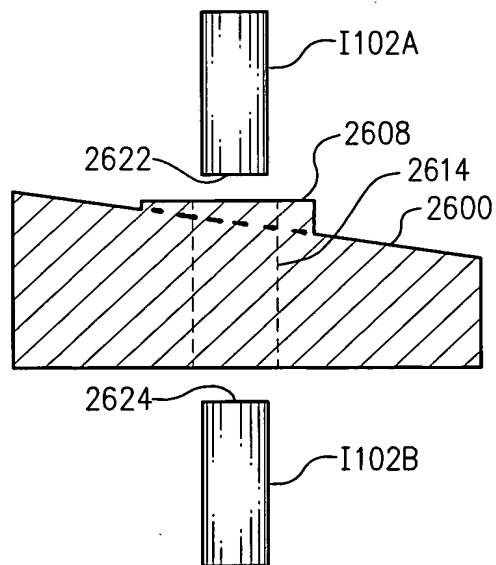
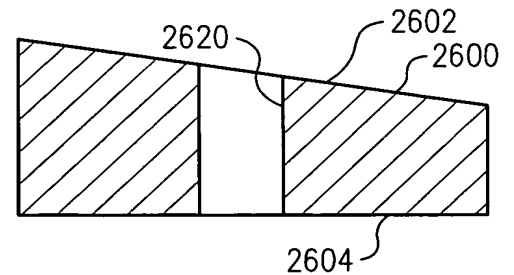


FIG. 103  
FINAL CONFIGURATION



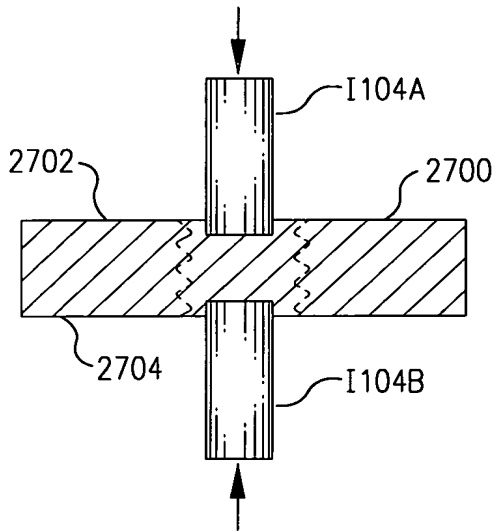


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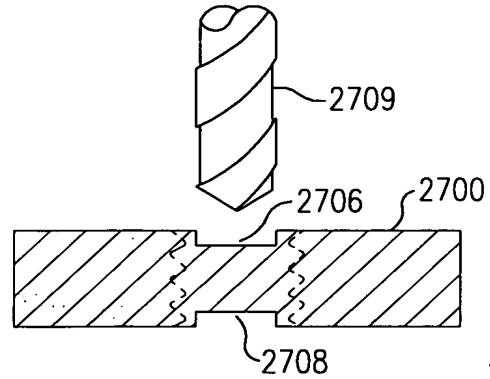
**FIG. 104**

PROCESS



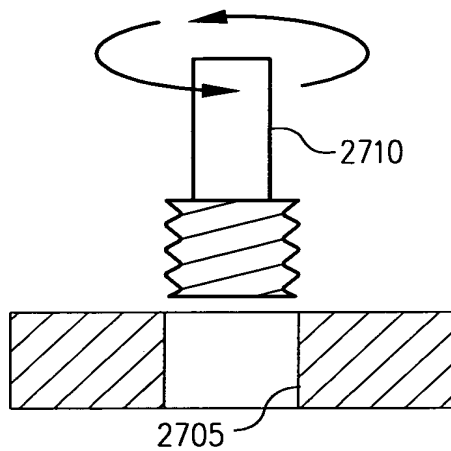
**FIG. 105**

DRILL HOLE



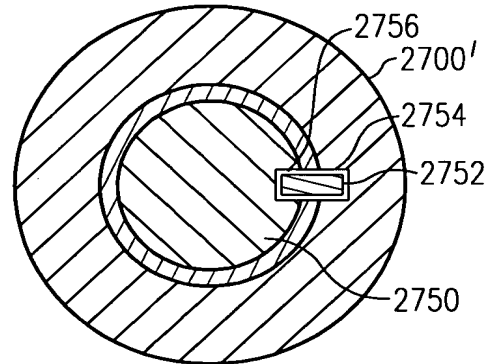
**FIG. 106**

MACHINE OR TAP THREADS

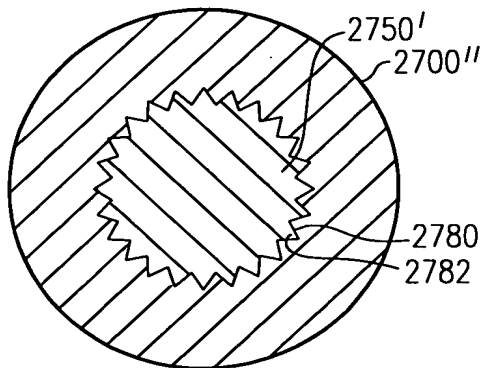


**FIG. 106A**

ASSEMBLED CONNECTION

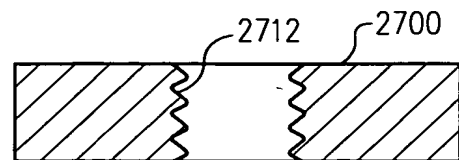


**FIG. 106B**



**FIG. 107**

FINISHED HOLE



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SIMULTANEOUS OR SEQUENTIAL TREATMENT  
OF A PATTERN OF HOLES, ONE-SIDED  
OR TWO-SIDED

FIG. 108

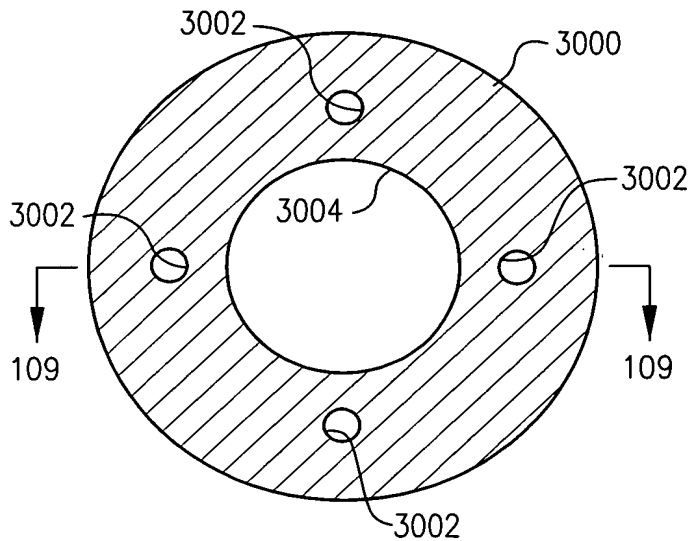


FIG. 109

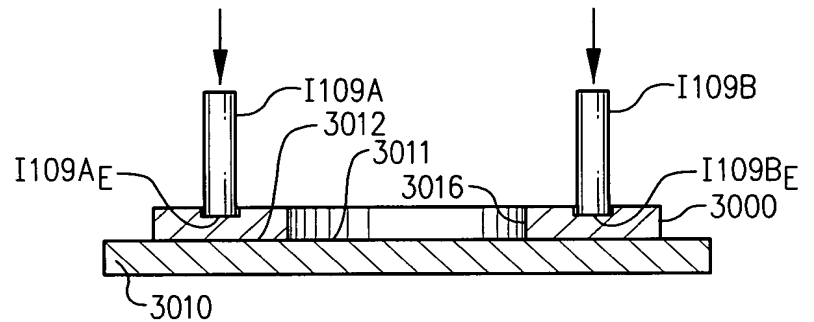
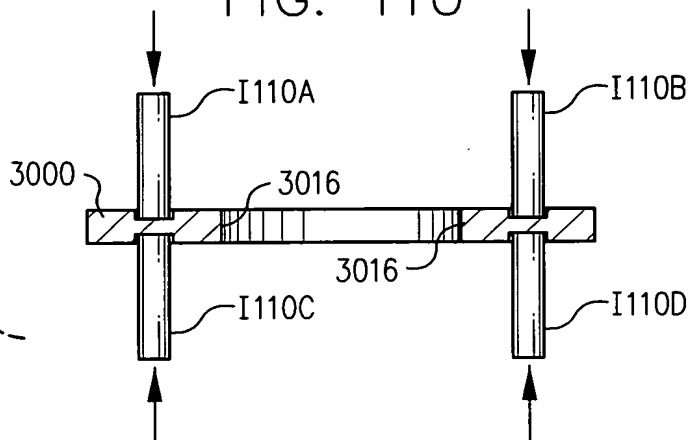


FIG. 110



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SIMULTANEOUS OR SEQUENTIAL TREATMENT OF  
 A PATTERN OF HOLES, ONE-SIDED OR  
 TWO-SIDED WITH INTERNAL SUPPORT

FIG. 111

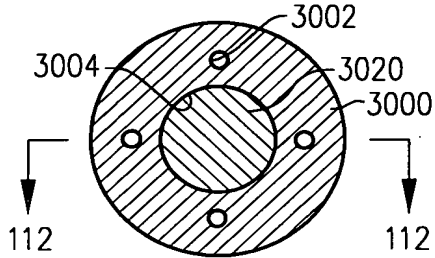


FIG. 112

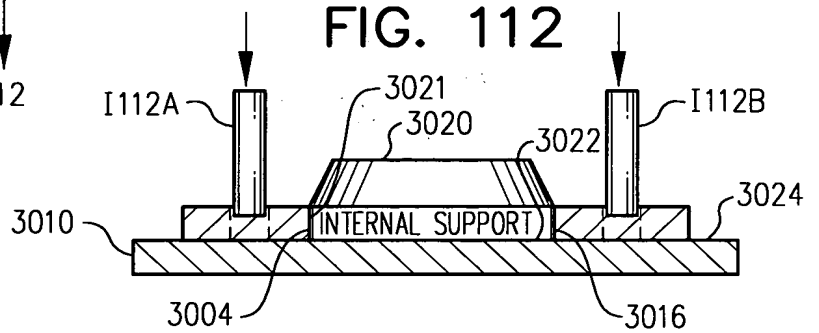


FIG. 113

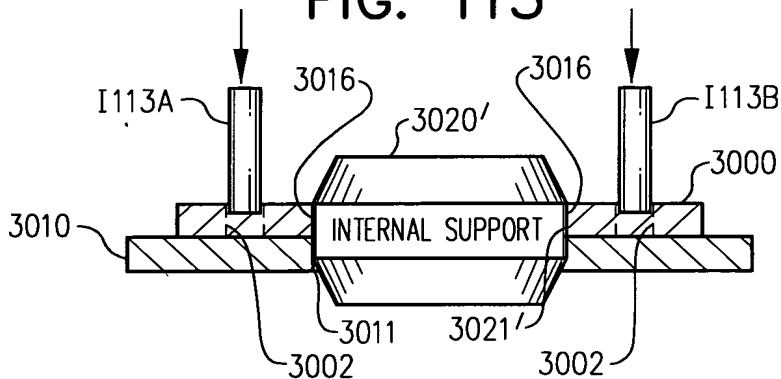
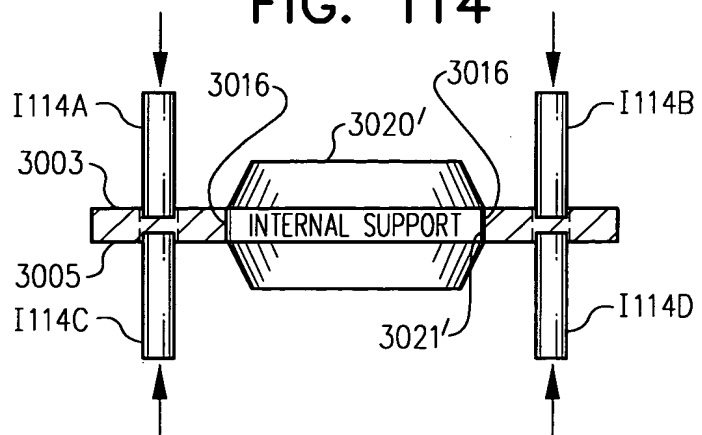


FIG. 114



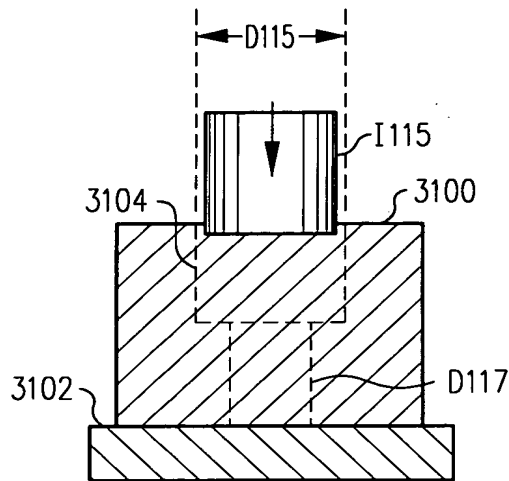
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## TREATMENT OF A STEPPED HOLE

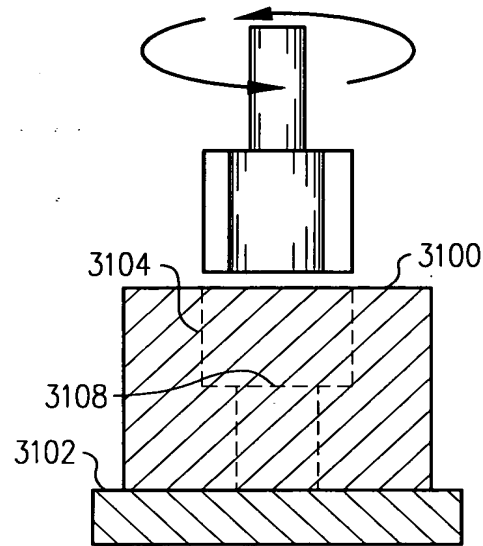
**FIG. 115**

PROCESS LARGE  
DIAMETER



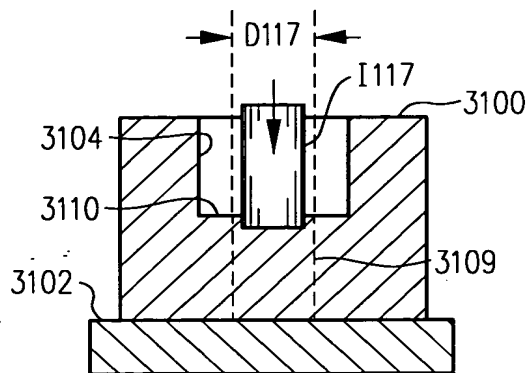
**FIG. 116**

MACHINE LARGE  
HOLE DIAMETER



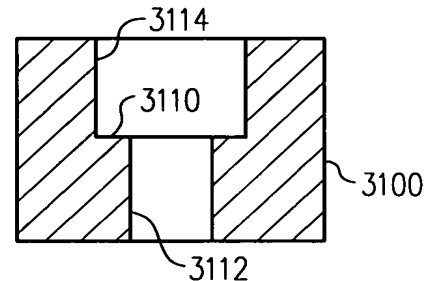
**FIG. 117**

PROCESS SMALL  
DIAMETER



**FIG. 118**

FINISHED PART AFTER SMALL  
DIAMETER MACHINED



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TREATMENT OF A DEEP PART

FIG. 119

PROCESS

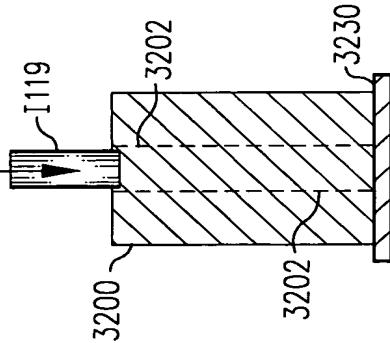


FIG. 120

MACHINE PARTIAL  
DEPTH

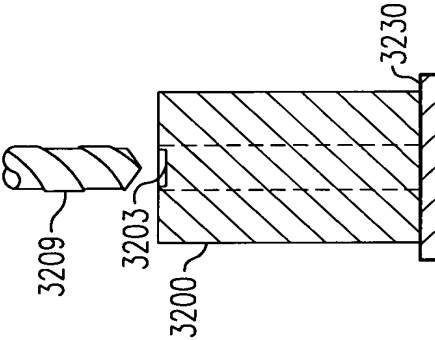


FIG. 121

MACHINED  
CONFIGURATION

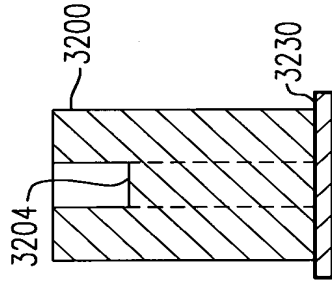


FIG. 122

PROCESS STEP #2

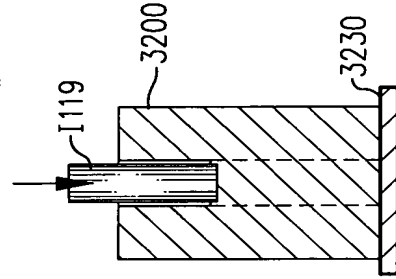


FIG. 123

MACHINE  
PARTIAL DEPTH

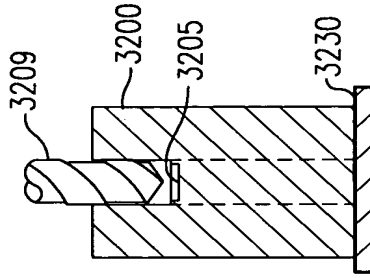


FIG. 125

PROCESS STEP #3

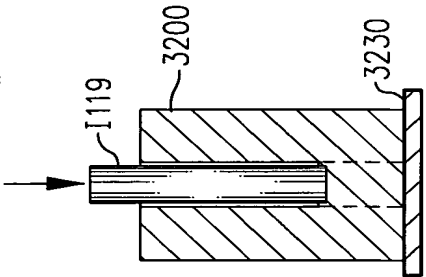


FIG. 124

MACHINED  
CONFIGURATION

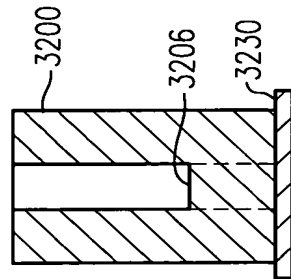


FIG. 126

MACHINE THROUGH DEPTH

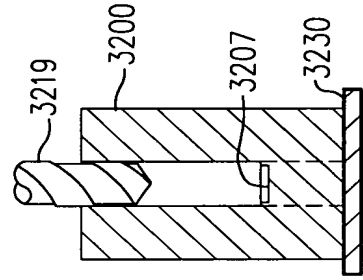
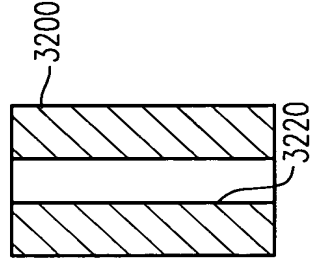


FIG. 127

FINAL CONFIGURATION



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FIG. 131

INTERIM MACHINED  
CONFIGURATION

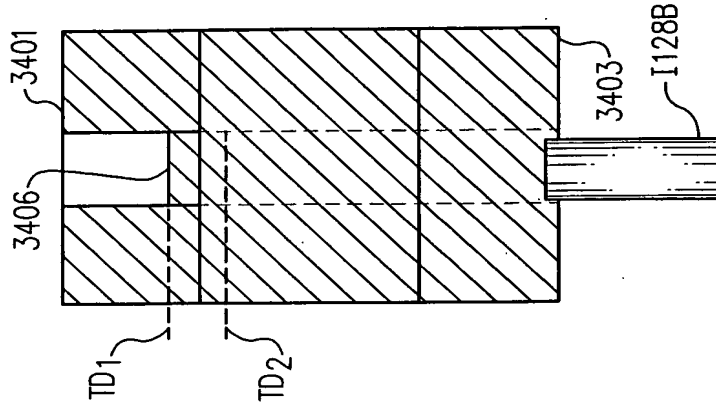


FIG. 130

SETUP STEP FOR MACHINING  
PARTIAL DEPTH

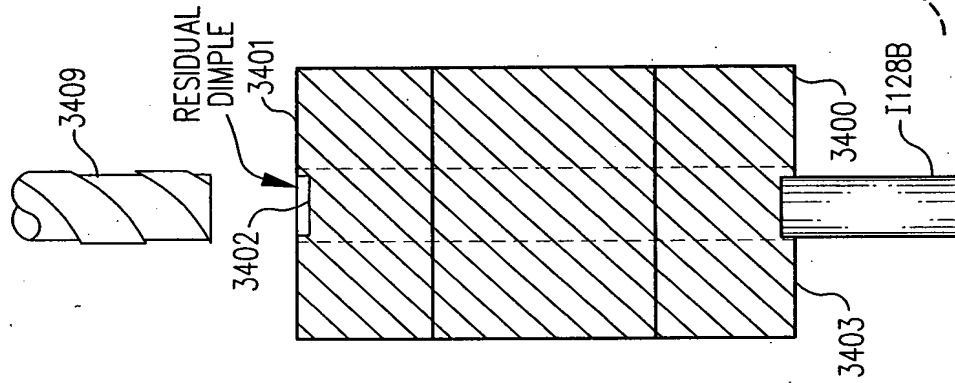


FIG. 129

REMOVE 1ST INDENTER  
UNLOAD 2ND INDENTER

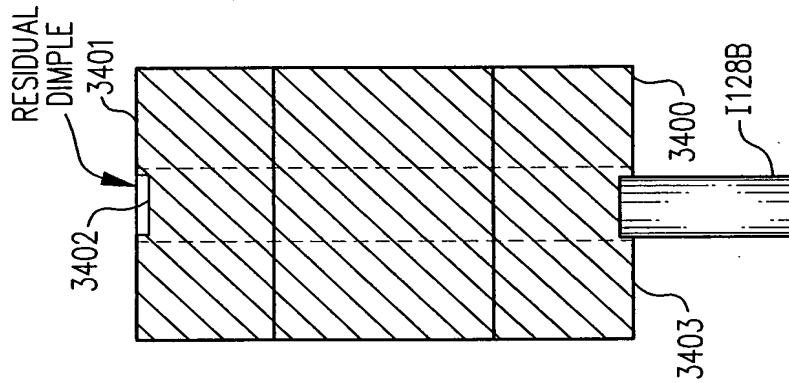
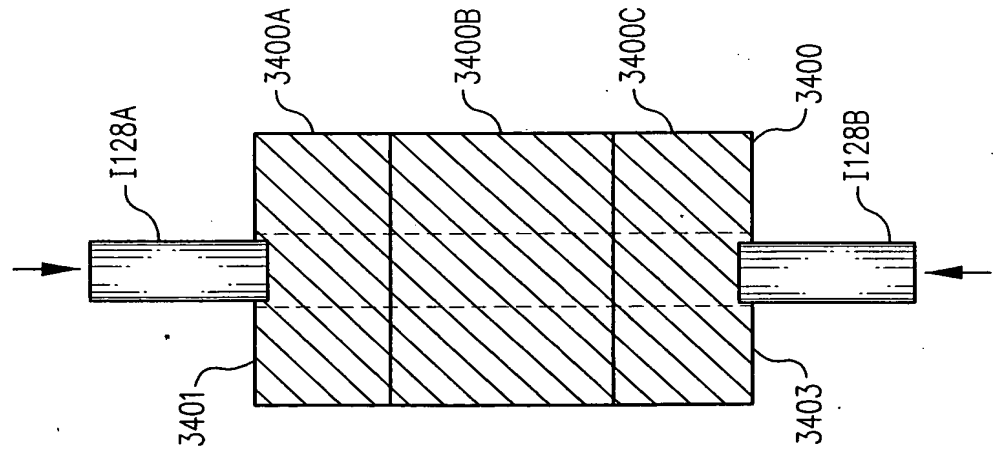


FIG. 128

ACTUATE INDENTERS



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FIG. 132

PROCESS STEP #2  
 ACTUATE INDENTERS

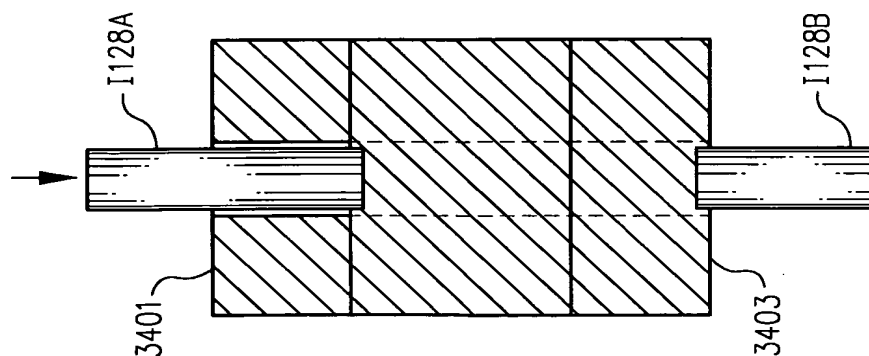


FIG. 133

RELEASE AND  
 REMOVE INDENTERS

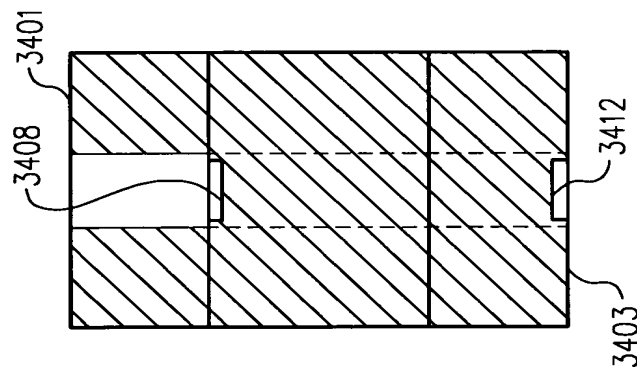


FIG. 134

FINAL MACHINE HOLE

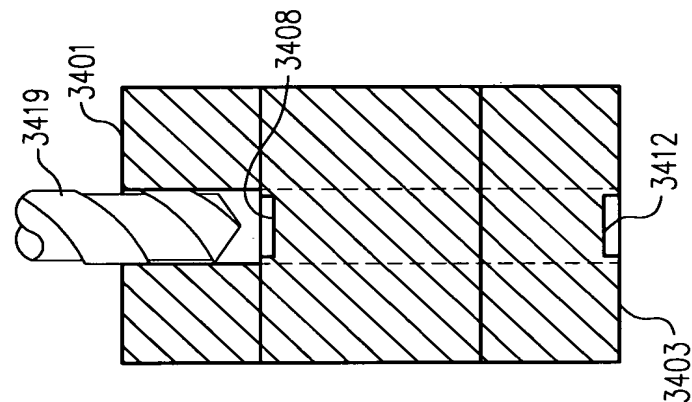
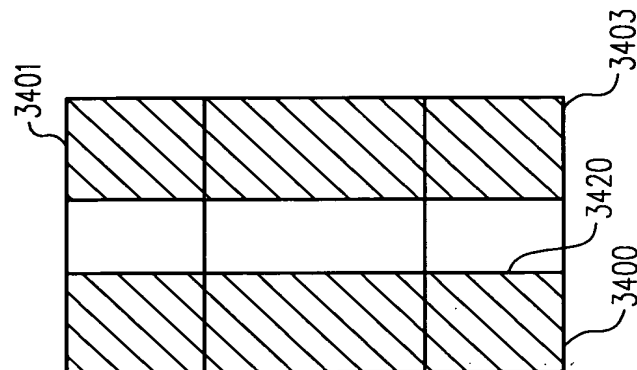


FIG. 135

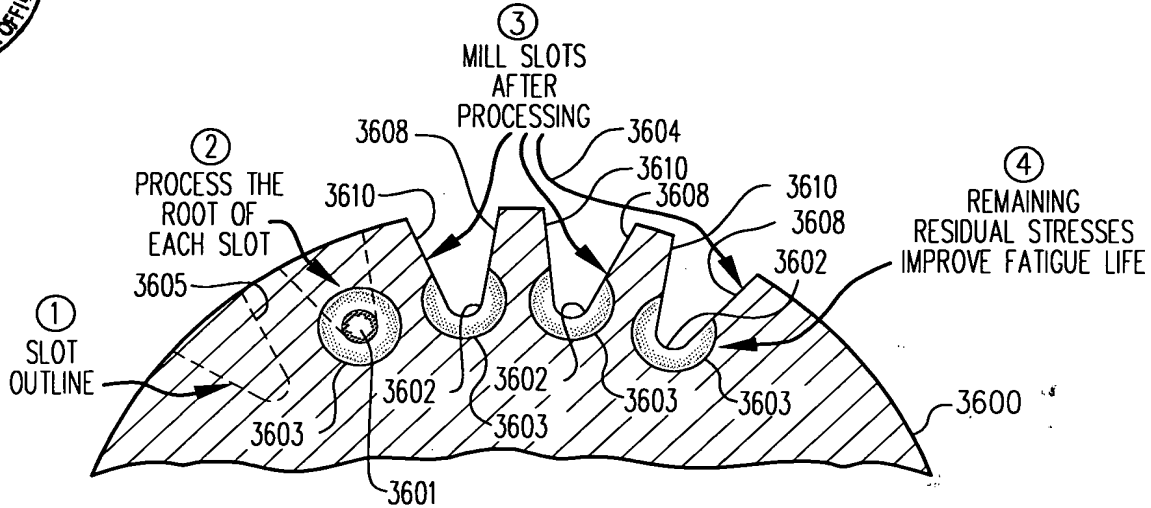
FINAL CONFIGURATION  
 NOTE: HOLE MAY HAVE  
 COUNTERSINK, COUNTERBORE,  
 STEP, OR OTHER FEATURE



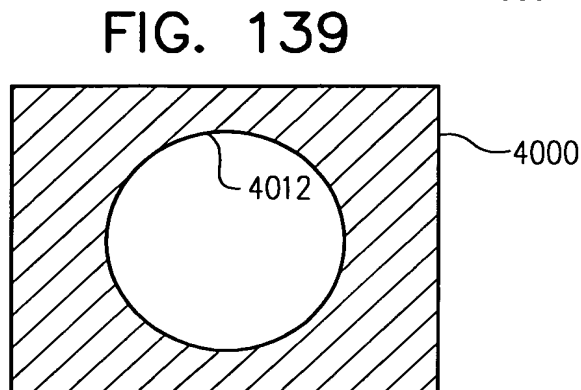
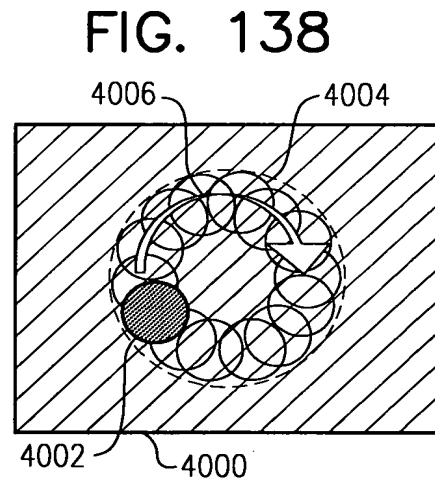
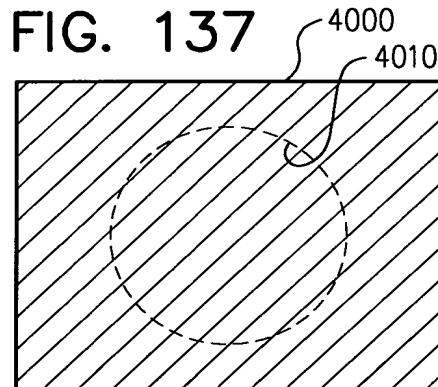
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**FIG. 136**  
 TREATMENT OF A SLOTTED STRUCTURE  
 SUCH AS A GEAR OR DISK



TREATMENT OF A ROUND APERTURE USING  
 AN OVERLAPPING PATTERN OF DIMPLES  
 AROUND THE PERIMETER





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TREATMENT OF A NON-CIRCULAR APERTURE  
 USING AN OVERLAPPING PATTERN OF  
 DIMPLES AROUND THE PERIMETER

FIG. 140

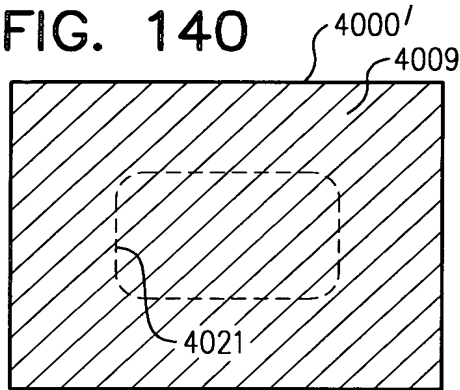


FIG. 141

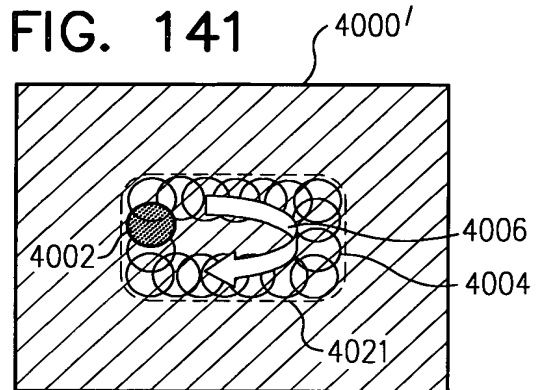


FIG. 142

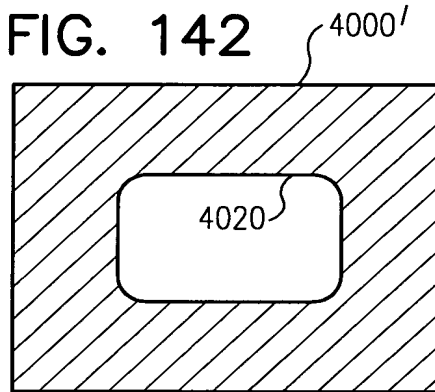


FIG. 143

INDENTER END SHAPE USING FLAT,  
 CHAMFERED AND CURVED PORTIONS  
 FOR APPROXIMATING A UNIFORM  
 PRESSURE PROFILE

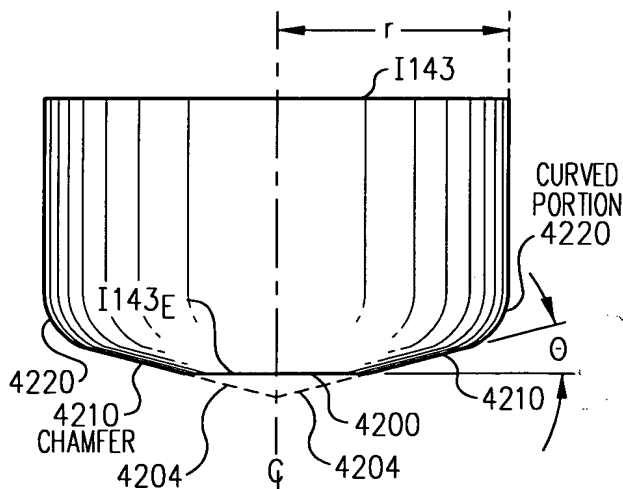
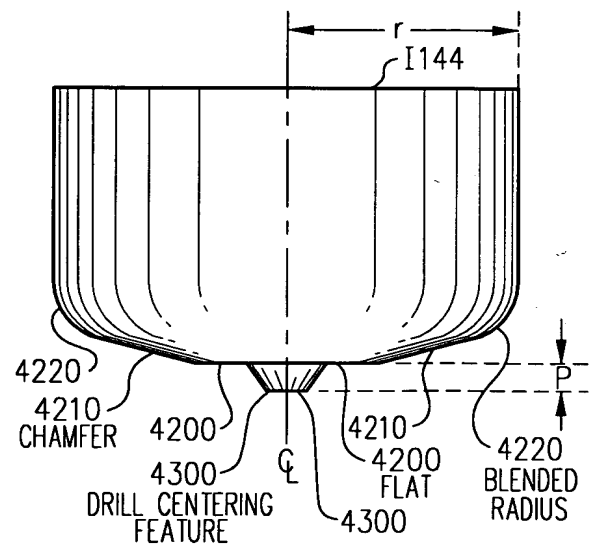


FIG. 144

INDENTER END SHAPE FOR APPROXIMATING  
 A UNIFORM PRESSURE PROFILE WITH  
 DRILL CENTER FEATURE

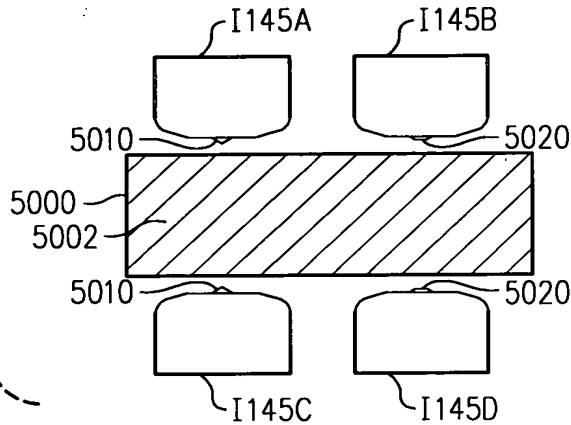


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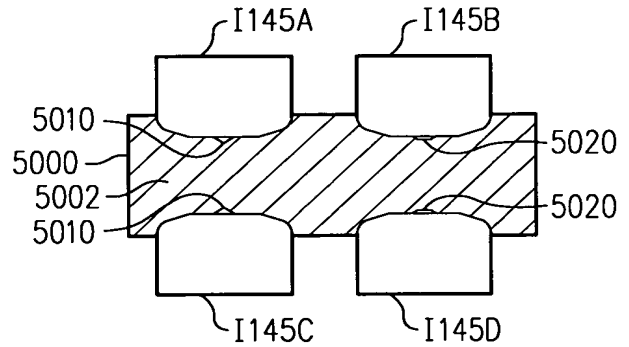
**FIG. 145**

SETUP STEP FOR TWO INDENTER END STYLES  
 WITH DRILL ALIGNING FEATURE. ONE CONICAL AND  
 THE OTHER TRUNCATED CONE



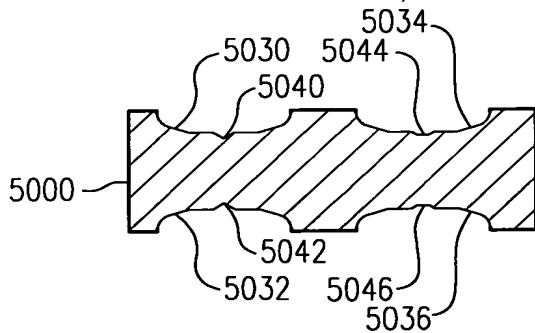
**FIG. 146**

ACTUATION OF INDENTERS INTO PART



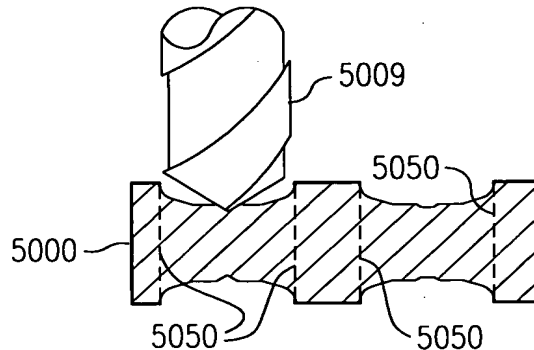
**FIG. 147**

CROSS SECTION OF DIMPLES  
 AFTER TREATMENT AND  
 INDENTER WITHDRAWAL



**FIG. 148**

DRILL OUT HOLE,  
 DRILL CENTERS ON DIMPLE



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FIG. 149

SETUP STEP FOR TREATING PART  
 WITH EXTRA THICKNESS USING  
 INDENTERS MUCH LARGER THAN  
 THE FINAL HOLE DIAMETER

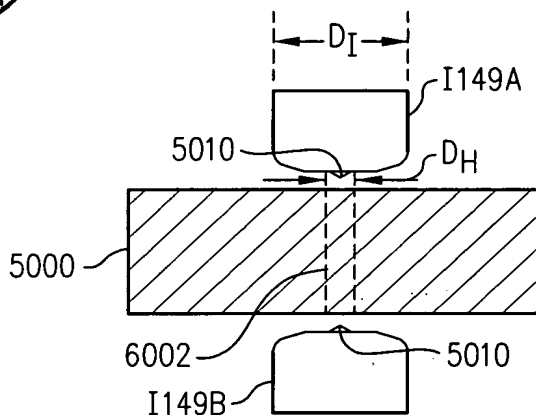


FIG. 150

ACTUATION OF INDENTERS INTO  
 PART, EXTENT OF RESIDUAL STRESS  
 WELL BEYOND THE FUTURE WALL OF  
 THE SMALL DIAMETER HOLE

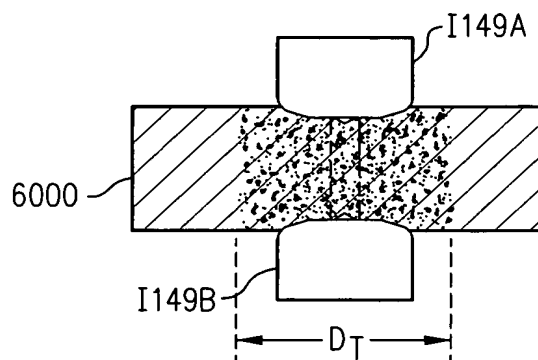


FIG. 151

MILL FRONT AND/OR BACK FACES  
 OF STRUCTURE TO REMOVE  
 DIMPLES—RESIDUAL STRESSES  
 MAY RELAX SLIGHTLY

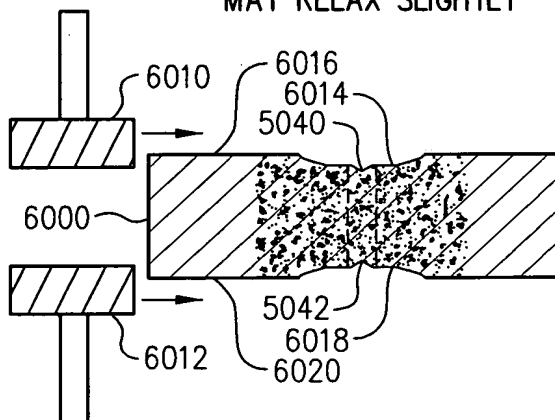


FIG. 152

DRILL OUT HOLE LEAVING  
 LARGE ZONE OF COMPRESSIVE  
 RESIDUAL STRESS

